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ABSTRACT

Issues and solutions in teaching and learning in higher education are addressed in 28 papers and 6 workshop reports from a 1982 conference of the Higher Education Research and Development Society of Australasia. Papers are grouped under the major categories of staff development, course evaluation, teaching and learning, and microcomputers in teaching and learning. Some of the paper titles and authors include: "Staff Development in a Climate of Retrenchment" (C.K. Knapper); "Professional Development of University Teachers: An Act of Faith?" (R.A. Cannon); "Staff Development: The Problem and Some Possible Solutions" (R.B. Gardiner); "Attitudes of Australian Academics to Staff Development" (J.A. Bowden & J. Anwyl); "Debriefing Academics about Their Teaching" (E.M. Barrett, J.P. Powell); "University Teachers' Evaluations of the Impact of Workshops on Their Teaching" (D.J. Boud, E.A. de Rome, J.P. Powell); "Laboratory Work at School and University" (R.G. Gabb, A.H. Mander); "A Pragmatic Evaluation of Practical Teaching in Science: The Method" (H.B. Guthrie); "The Overgrown Lecture Course: A Case for Radical Pruning" (L.W. Andresen); "Individualisation: Problems and Potential" (M. Pearson); "Bridging the Mathematics Gap" (J. Taffe); "Designing Instructional Modules in Training Programs Using Microcomputers: An Interactive Approach" (A. Gelder, A. Maggs); and "Allocating Grades Depends on Study Quality" (B. Imrie). (SW)

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Research and Development in Higher Education

Volume 5

Edited by Ian R. Dunn

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Research and Development in Higher Education

Volume 5

Papers presented at the eighth annual conference of the Higher Education Research and Development Society of Australasia, Clairmont Inn, Sydney 7-10 May, 1982

Conference Theme:
Issues and Solutions in Teaching and Learning in Higher Education

Edited by
Ian R. Dunn
School of Physics
University of New South Wales

HERDSA

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Preface

HERDSA, the **Higher Education Research and Development Society of Australasia**, was formed at a meeting of tertiary teachers, researchers and administrators, all of whom shared a common interest in research and development in higher education, held during the 1972 ANZAAS Congress at the University of New South Wales. 1982 thus marked the 10th Anniversary of the Society's foundation.

It was fitting that 1982 also took the Society's annual national conference back to Sydney, the city in which the founding meeting was held. The conference, the Society's 8th, focussed on **Issues and Solutions in Teaching and Learning in Higher Education.**

In keeping with the anniversary occasion the two keynote addresses each looked back over the last four decades of tertiary education in Australia. The first examined Australian higher education research*, and the second, the significant developments in teaching which had occurred over that period. The wide range of other activities on the conference program - special interest sessions, specialist workshops, reports on research work and on development work, etc. - reflected both the anniversary occasion and the basic concerns which originally spawned the Society.

This volume, **Volume 5 of Research and Development in Higher Education**, contains most of the papers presented at the conference, and reports from many of the specialist workshops. The papers have been grouped into five chapters which reflect the major issues addressed during the conference. The final chapter, chapter 6 is devoted to workshop reports. The conference was a lively one and so this volume should contain much to interest anyone with a concern for the theory and practice of tertiary education.

[* A detailed account of Australian higher education research is given in:

Anderson D.S. and Eaton E. (1982), Australian Higher Education Research and Society. Part I: Post War Reconstruction and Expansion: 1940-1965, Higher Education Research and Development, 1, 5-32.

Anderson D.S. and Eaton E. (1982), Australian Higher Education Research and Society. Part II: Equality of Opportunity and Accountability: 1966-1982, Higher Education Research and Development 1, 89-128.]

Acknowledgements

In judging a conference individual participants take many things into account - the impact of their own presentations; new perspectives gained; friendships renewed and made; the venue - accommodation, catering, surroundings, facilities; organisational details; etc; etc... The overwhelming consensus from participants was that the conference had been highly successful in almost all respects.

This success was due to many factors. Firstly to the speakers, presenters and workshop leaders for their well presented and stimulating contributions; and secondly, to the participants who, as always, created that unique HERDSA conference atmosphere.

The third contributing factor was the conference venue. In a break with tradition the conference was held at the Clairmont Inn, Kings Cross, a centrally located motel which provided excellent accommodation and conference facilities at reasonable cost, and not in the usual teritary education institute environment. This venue, together with the service provided by John Bunnyan, the manager, and his staff were acknowledged by all.

The fourth, and most important factor, was the conference organising committee. The members of this team, Dave Boud, John Powell, Jackie Lublin and John Henderson each put in a considerable amount of work and effort in providing the support and assistance so necessary for me as conference convenor. I am deeply grateful to each of them.

Finally my sincere thanks go to the conference secretary Toni Benton, who not only looked after all of the pre, during, and post conference typing, but also handled registration and a myriad of other matters at the conference desk. As always she did a superlative job.

IAN R. DUNN

Chapter 1:

STAFF DEVELOPMENT

The enhancement of the professional skills of academic staff has been a concern of many universities and colleges for some years but the resources devoted to this task have been meagre and the achievements modest. Knapper reports on the ways in which instructional development units have sought to improve the quality of teaching and learning and how they are responding to the straitened financial circumstances of the higher education sector. Cannon seeks an explanation for the limited success of staff development programmes through an analysis of institutional organization and the characteristics of the academic profession. This theme is pursued by Gardiner who recommends approaches which recognise the needs of staff and thus avoid undermining their morale and self-esteem.

Staff development activities have been hampered by a lack of systematic knowledge of the values, beliefs and attitudes to be found among members of the academic profession. Genn provides further data from his survey of 800 academics which indicate a number of factors which should be heeded by those responsible for designing staff development programmes. Reporting on a further survey of the attitudes of Australian academics to staff development, Bowden and Anwyl discuss their findings in relation to the claims and policy statements advanced in some recent published documents.

The highly problematic nature of staff development and its uncertain outcomes ensures that an increasing array of approaches will be tried by those responsible for assisting academics to extend their professional skills. Anis and Cheng describe a series of residential workshops conducted in Malaysia and identify some principles which can be used in the design and conduct of such workshops in order to increase their effectiveness. A completely different approach is outlined by Barrett and Powell who used a series of interviews to assist university teachers to reflect upon their teaching as an aid to making it more productive and satisfying. The most commonly used technique for the improvement of teaching is the workshop but little is known about how this is valued by participants. Boud, de Rome and Powell report findings from a survey of 220 staff which sought their views on the impact of workshops in their work as teachers. Information was also obtained on staff perceptions of factors which impeded their efforts to improve their teaching.

The final section, a report from the symposium which examined Australian **Staff Development in the 80s** and organised by Lonsdale, provides an overview of current and projected staff development initiatives at both the state and national levels. Also included are reports (Boud, Ross, Hawkins, Cannon) of responses by the Federation of Australian University Staff Associations and by individual institutions to the recent AVCC Working Party on Staff Development's report, and a reaction in the context of developments occuring in other countries (Knapper).

Staff Development in a Climate of Retrenchment (1)

Christopher K. Knapper
University of Waterloo

ABSTRACT

The late 1960s and early 1970s saw a rapid growth in educational development units, established in many universities in the developed English speaking world with the aim of improving the quality of teaching and learning. In 1973-74 the writer made an informal survey of the instructional development movement in Britain, North America, and Australasia. This survey is currently being updated in an attempt to determine what changes have occurred, and how such units have responded to the present climate of severe financial constraints affecting higher education in many parts of the world. A particular focus is upon the way methods of teaching and learning may have changed in the past seven years, what is the impact of technology based instruction, and to what extent are universities successfully preparing students to be lifelong learners.

Professor Christopher Knapper, B.A. (Sheffield), Ph.D. (Saskatchewan) is Teaching Resource Person at the University of Waterloo, where he also holds a professorship of Environmental Studies. He has written extensively on educational evaluation and instructional technology, and recent books include Evaluating Instructional Technology (London: Croom Helm, 1980) and Expanding Learning Through New Communications Technologies (San Francisco: Jossey-Bass, 1982).

Address for Correspondence: Prof. C. Knapper, Teaching Resource Person, University of Waterloo, Waterloo, Ontario Canada N2L 3G1

THE CRISIS FACING HIGHER EDUCATION

Following a period of rapid expansion during the 1960s, the past decade has witnessed a period of increasing financial and political difficulties for universities in Western Europe, North America, and Australasia. Although the precise causes of these problems are still a matter of debate, the symptoms involve reduced income, levelling or declining student enrolments, attrition of teaching and support positions, an increasing public disillusionment with the contribution of higher education to the quality of life, and greater political pressure on institutions of higher learning to make themselves in some sense "accountable" for public expenditures.

Reactions to this pessimistic scenario among the academic community have been varied. In some instances there have been vigorous denials that any problem exists that cannot be solved by the injection of more money into higher education. Others have called for a return to the "traditional" values of the university, which is often seen as involving the provision of a high quality, non-vocationally based education for a small, but elite, group of the most able students. Somewhat in contrast are those educators who see retrenchment as a challenge to higher education and an opportunity for universities to re-think their role in the light of changing societal needs.

The ultimate criterion of any university's success is its ability to promote effective learning, and hence it is of particular concern to examine how a climate of constraint can affect the quality of teaching or learning for better or worse. The present paper attempts to explore this question, focussing on three inter-related issues. Firstly, what has been the success of formal attempts to improve the standard of teaching and learning through staff development centres, and how have such centres coped with the recent financial retrenchment? Secondly, how have developments in educational technology been used to change the practice of teaching and the effectiveness of learning? And, thirdly, to what extent have universities been successful in equipping students with appropriate lifelong learning skills in a time of rapid social and technological change? Exploration of these questions is based in part upon two study tours carried out by the author in 1973-74 and 1981-82, and which involved discussions with educators in a number of English speaking, developed nations in Australasia, Europe and North America.

THE IMPACT OF STAFF DEVELOPMENT

The growth of formal centres to improve teaching and learning effectiveness is a relatively new phenomenon in Australasian, North American and European universities. It might be expected that the staff at such centres would be particularly sensitive to the learning climate in universities, and would be well placed to change teaching and learning methods and to encourage new attitudes to university education in general. In practice, it is probable that a great amount of staff development activity is directed to far more mundane ends. The most common activities for many staff development units include running short workshops, providing individual consultations with faculty, and publication of a newsletter or brochures on various aspects of teaching. In some institutions there is also a modest small grant programme to encourage innovative approaches to education. Given the extent and type of these activities, it is hardly surprising that the staff development movement has probably had very little general impact on university teaching and learning. Reasons for this have been discussed at length elsewhere (see, for example, Improving University Teaching, 1980; Rhodes and Hounsell, 1980).

In many institutions - especially in the current economic climate - staff development units are presently embattled, and under pressure to demonstrate their usefulness. Hence the temptation to devote considerable effort to the organisation of public activities (workshops, newsletters) that may influence only a tiny group of loyal enthusiasts within the institution, and fail to affect the wider community. Perhaps even more important, however, is the fact that broader conceptual and philosophical issues relating to university education are often ignored. For example, to judge by the content of many unit publications, it might be thought that the way to solve the universities' current problems is primarily a matter of tinkering with existing teaching methods, using appropriate visual aids, and experimenting with the occasional modest innovation.

While there are of course some notable exceptions, many staff developers have unfortunately concentrated far more on the minutae of improving teaching and learning, and have ignored broader conceptual issues. This tendency is probably reinforced by the "service agency" role adopted by many staff development units, and their general lack of status or prestige within the organisational hierarchy of the institution. In Ontario, for example, although nearly all the universities maintain some type of instructional development activity, some with grandiose-sounding titles, the number of senior-level academics centrally involved in staff development is very small. This is doubly unfortunate, since if staff development is to have any influence on the major philosophy of the university, it will need spokespersons who speak with authority and who are capable of affecting policy. Of course the cynic may argue that the forces of conservatism will see to it that staff development never does more than serve a cosmetic, political function aimed at persuading the public that the university is concerned about teaching - but only as long as there are no fundamental changes in university structures and priorities.

THE PROMISE OF INSTRUCTIONAL TECHNOLOGY

Staff development has traditionally had close links with educational technology, and some instructional development units have actively promoted technological innovations as the key to more effective learning. On the face of it this seems an extremely promising idea, since the society of the future is likely to be increasingly technology-based, and it seems plausible that the ability to comprehend, use, and make appropriate decisions about technological innovations are important lifelong learning skills for students to acquire. Although successive instructional technologies have been expected by their developers to revolutionise teaching, in practice the expected wholesale changes have largely failed to materialise, so that university level instruction remains generally traditional. While only time will tell whether this fate will befall computer based learning, to date it is true to say that although computers have had a fairly major influence on teaching technological skills (e.g. computer programming taught by computer), their impact on other forms of learning has been minimal.

There are almost as many reasons for this state of affairs as commentators to explain them - ranging from arguments concerning costs to speculation about faculty resistance (for a more complete review see Knapper, 1980). A very important point about the use of instructional technology, however, is the recognition that any effective teaching method must not only involve an efficient system for providing information, but also needs to pay due respect to the learning process experienced by the student. Just as a great deal of lecturing takes place in ignorance of how students are learning in the course, so sophisticated computer hardware is often confused with a sophisticated learning system. When critics talk about the problems of adequate software in computer-based instructional systems, they are referring not only to the unavailability of a broad range of course material, but also to the importance of designing learning materials that respond to learner needs and exploit the instructional system to its maximum potential. In this sense those writers are correct who define instructional technology as a systematic approach to learning, which can theoretically exist in the absence of "technology" as that term is usually understood by the layperson. At the same time, to bring most university teachers to this type of understanding is probably as difficult in the case of technology based learning as it is for any other teaching system. Indeed, it may be the case that instructional technology is resisted not because it is seen as a threat to job security among university teachers (where it has yet to make any significant inroads) but as a threat to professional competence in teaching for faculty who are reluctant to emerge from the protective cocoon of familiar teaching methods.

THE CONCEPT OF LIFELONG EDUCATION

Among those who regard the constraints affecting higher education not as a cause for despair, but as an impetus for change, many have drawn attention to the educational opportunities provided by new student populations and the changing needs of learners. In particular, considerable interest has been generated by the concept of lifelong learning and its relevance for the contemporary university. Although the underlying notion of learning throughout life is far from new, lifelong learning was more recently restored to prominence by the publication of the Faure report in the early seventies and the subsequent adoption by UNESCO of "l'education permanente" as its guiding

principle for education (Faure, 1972). In the United States the passing by Congress of the Lifelong Learning Act in 1976 similarly drew the attention of colleges and universities to the fact that learning need not be confined to the traditional population of 18-21 year old students. Of course many institutions of higher education already had heavy involvement in extension (extramural) programmes. What appeared to be new was the notion that this type of instruction need no longer be considered as a "fringe" activity, but could indeed be justified as the major goal of the university.

There is some evidence that in the eagerness to develop a new raison d'être (and income) for the university and discover new sources of students, the notion of lifelong learning was embraced without a true comprehension of the meanings and implications of the concept. In North America, lifelong education is often seen as a synonym for adult education or continuing education. It is of course encouraging to see universities recognise that learning is not a process confined to the period between infancy and early twenties, and admit that they have a responsibility to provide learning opportunities for adults, for part-time students, and in off-campus locations. However, this conception of lifelong education seems unduly restrictive. In the first place, courses offered outside the traditional university programmes are all too often carbon copies of regular on-campus offerings, and frequently may disregard the special learning needs, prior experience, and learning styles of non-traditional students. Secondly, even where continuing education is organized with greater sensitivity and innovation, there is still the danger that, as Cropley (1977) has pointed out, lifelong education is regarded as the equivalent of lifelong schooling. Tough's well-known study showed quite clearly that very large proportions of Canadian adults are regularly engaged in self-directed independent learning, without any assistance from formal educational institutions (Tough, 1971). And one of the foremost commentators on lifelong learning in the United States, Patricia Cross, has argued forcefully against the total institutionalization of this type of informal learning - however much universities may be in need of new groups of students to swell their enrolment statistics (Cross, 1979).

This is not to argue that universities should ignore the needs of adult students, and indeed the increasing trend to providing a wider range of opportunities for part-time studies, continuing education, and recurrent education for professional upgrading is to be applauded. At the same time, this is only a partial solution to the facilitation of lifelong learning as envisaged by Faure. In particular, the lifelong learner is presumably someone who neither wants nor needs to spend a lifetime attending courses, but who has the skills to direct his or her own learning on the basis of a variety of available resources, including libraries, museums, the experience of colleagues in the workplace, and so on.

LEARNING TO LEARN

Not only are people capable of learning throughout their lives (Lovell, 1980), but it is essential for most of us that we do so. Among the more obvious reasons for this is the so-called knowledge explosion, which means that in the formal years of schooling it is possible to present only a small fraction of the information available on a given subject, and that in very many cases even this information rapidly becomes obsolete. In addition to the exponential expansion of known facts about the world is a rapid evolution of job-related skills, so that new abilities are suddenly in great demand, while other traditional crafts may no longer be needed. The most obvious contemporary example of this is probably represented by the world-wide shortage of people with computing skills, whereas - to cite an unrelated example - the ability to take shorthand dictation is probably becoming an increasingly redundant skill, except for a few fairly specialised applications. (On the other hand, at the University of Waterloo, it is estimated that at least a third of secretarial employees operate computer-based word processing equipment as part of their normal daily duties.)

Given this scenario of rapidly changing skills and knowledge, it is not surprising that proponents of lifelong learning, such as Cropley (1977, 1978), have argued not just for a system of continuing or recurrent education, but have equally emphasised the importance of students in the traditional school system being able to "learn how to learn". In other words, there is a need to equip students during the conventional school years with independent learning skills that will enable them to adapt to a changing world and allow them to be effective learners of new information and skills throughout their adult lives. Acceptance of the central importance of learning how to learn has, of course, profound implications for the organisation of instruction in schools and universities.

Universities typically work at the "leading edge" of knowledge, and hence their curricula and teaching methods might be expected to be especially susceptible to rapid change. While it is not an easy matter to assess how far university curricula in different subject matters and different countries truly reflect the most recent thinking in the discipline, the ways in which students learn in many universities are often not at all conducive to the provision of lifelong learning skills as envisaged by Faure, Cropley, and others. In North America, for example, the principal teaching devices are still the formal lecture and laboratory, despite doubts that these methods are the most effective ways of teaching conceptual thinking or problem solving skills. (2)

It is argued, then, that a major task of the university is to promote learning abilities that will enable students to do more than master specific skills and information, and instead embody skills and attitudes that will allow learning throughout life in frequently changing circumstances. At the same time there exist doubts that universities are presently achieving this type of education, or even completely understand this conception of lifelong learning. If this is so, then what can be done to remedy the situation? In particular, is there a role to be played by staff developers in alerting the university community to the changing learning needs of students?

SOME POSSIBLE SOLUTIONS

It has been argued so far that the current crisis in higher education requires a fundamental re-thinking of the teaching role of the university. In particular there is a need to de-emphasise the teaching of a circumscribed body of information and instead to develop means of promoting lifelong learning skills. While the staff development movement and innovations in educational technology offer promise for improving student learning effectiveness, so far that promise has not been fully realised. The problems of making fundamental changes in the light of firmly entrenched attitudes and teaching behaviours are admittedly formidable, but the following are suggested as possibly fruitful lines of action for professional staff developers as well as those teachers who are committed to changing the type and quality of student learning in higher education.

1. Take every opportunity to stress the importance of the learning process as opposed to teaching techniques. This point has been elaborated above with respect to instructional technology, but it is equally crucial for any educational innovation. Since staff developers are frequently called upon as consultants when innovations are being tried, they are often in an excellent position to draw attention away from the razzmatazz of a novel presentation device and instead ask some hard questions about exactly what type of learning takes place as a result.

2. Forge links with those areas of the university that are likely to expand rapidly in the near future, and which may welcome advice and be receptive to innovative ideas. Some likely candidates were discussed earlier in this paper and include the whole field of distance education, adult and recurrent education. Since these approaches all involve teaching in an unfamiliar context, where tried and true methods cannot readily be used, they present special opportunities and challenges for instructional developers.

3. Use every opportunity to try and relate university learning to real life situations in which knowledge and skills will actually be used. Depending upon the particular national and institutional context, this might involve the encouragement of co-operative education (sandwich courses), the development of project-based learning, simulations, student-directed learning and assessment, exploration of the value of a much wider range of field placements than is traditional (i.e. perhaps in political science and chemistry as well as psychology and social work). It will be noted that all the approaches listed above emphasise a good deal of student initiative in the learning situation as opposed to teacher-centred or expert-directed instruction. This recognises the fairly obvious truism that, regardless of the instructional method, learning is largely in the hands of the student, although the effectiveness of such learning can be aided immeasurably by the guidance of a knowledgable teacher. It seems likely that a good many university instructors are uncomfortable in roles outside those of the traditional didactic lecturer/expert. And yet there is a good deal of cumulative experience about, for example, the teacher as "resource person/facilitator". Exposing instructors to alternative teaching/learning roles, and providing appropriate training - or, better still, learning opportunities - for instructors seems an extremely relevant task for staff

development centres. It might do much to encourage effective lifelong learning skills for students by providing models of the learning process itself that are far more appropriate than those suggested by many traditional teaching approaches.

4. Encourage research on basic processes underlying teaching and learning, and help disseminate the results of such research. Research has a very special place in universities because of the high priority it is accorded by the institution itself and by many staff members. Hence it is often possible to use research findings as a focus of interest and a source of persuasion. Some staff development units in North America and Europe devote a large part of their effort to research on university teaching and learning, and in some cases (though probably a minority) this research has provided major theoretical insights into our understanding of the learning process. It is probably not necessary that most staff developers become researchers, and indeed this may be undesirable in that it diverts attention and resources away from the development role itself. At the same time, however, it is incumbent upon those actively involved in staff development work to be familiar with the relevant research and - more important - to advise their colleagues on the relative merits of research relating to the discipline concerned.

A great deal more could be done to disseminate research findings on university-level instruction among the academic community. Furthermore, staff developers could do a lot to encourage colleagues within the disciplines to undertake their own research into learning processes as they relate to different subject fields. To a certain extent this is already done through the mechanism of small grants programmes operated by some staff development centres. However, the modest sums available necessarily limit the scope of such research efforts. One possibility would be to lobby more aggressively for co-operative research efforts sponsored by research councils or government agencies, which would attract not only staff developers and educational researchers but also distinguished scholars from a range of disciplines. Interesting initiatives of this sort have been taken recently by the British Society for Research into Higher Education in its involvement with the National Enquiry into the Future of Higher Education, but a good deal more could be done. Although staff developers may seem a relatively small and uninfluential group, they can on occasion form an effective lobby through the mechanism of professional associations related to teaching and learning as indeed has been done recently by HERDSA in its reaction to the Williams Report and its submission to the AVCC Working Party on staff development. In practice such associations - at least in North America - have often been reluctant to see themselves as sources of political influence, but the present time of financial constraint may be an appropriate moment to develop new roles of this type.

A further role for staff developers in relation to research might be to serve as a link between researchers in learning and teaching and practitioners - not only through the dissemination of relevant research findings, but also by suggesting appropriate settings for research on learning processes. Staff developers' unique range of contacts within their institution often places them in an excellent position to identify receptive settings for research. The term "practitioner" as used above is primarily intended to refer to university teachers; however, co-operation with interested groups of students is by no means out of the question. At the University of Waterloo, for example, the Federation of Students has consulted with the Teaching Resource Office in connection with some small scale research projects. The Office has also co-operated with graduate students in various applied programmes on dissertation projects that involve an investigation of some aspect of the learning process.

The range of possible subjects for research is obviously very large, but some promising areas appear to be the function of individual differences in learning, the concept of androgogy (especially the question of whether adults learn differently from younger university students and, if so, in what ways), the sociological climate in universities and its effects on learning (to cite one small example, whether or not the presence of adults in a learning situation alters the learning climate), interrelationships between instructional approaches and learning styles (following the work of Entwistle, Marton, Pask, etc.), and studies of the long-term effects of learning experiences - concentrating especially on the effectiveness of instructional strategies to encourage life-long learning skills.

To a certain extent it might be argued that staff development units already perform most or all of these functions. True, but often in an unco-ordinated manner which

seriously reduces any impact upon the university community at large. What is being argued here is that there is an urgent need for the staff development movement to arrive at a set of priorities - both for the work within individual institutions and for efforts at a national and international level. Failure to do this will result in the very valuable work done by many individuals being overwhelmed by the concerns of their colleagues merely to survive in the present economic climate. This would be unfortunate and ironical, since the purpose for which staff development units were created was to help improve the central function of the university - the promotion of learning - without which long term institutional survival will be impossible.

NOTES

(1) An earlier, unpublished version of this paper was presented at the Fifth International Conference on Higher Education, held at the University of Lancaster in September 1981.

(2) There is a good deal of evidence concerning learning from lectures, summarised well by Bligh (1972). The efficacy of traditional laboratory instruction has been the subject of considerable debate in both Europe and North America - see, for example, Pickering, 1980, and the extensive correspondence that ensued in the Chronicle of Higher Education. J.V. McConnell, in his 1980 presidential address to the Division on Teaching Psychology of the American Psychological Association, presents a wry but disturbing account of his experience as a distinguished professor who went back to study medicine at the University of Michigan and encountered at first hand the problems of learning from lectures and labs (McConnell, 1980).

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Professional Development of University Teachers: An Act of Faith?

Robert A. Cannon
The University of Adelaide

ABSTRACT

Teaching is the major professional activity of academic staff in Australian universities. Much disquiet about the quality of this teaching has been expressed by governments, committees of enquiry, students and by academics. There have been several attempts to improve the quality of university teaching, most of which have been considerable acts of faith. The persistence of disquiet, however, suggests that past efforts to improve the quality of university teaching have not been completely successful.

An analysis of universities as organizations, of the characteristics of academic staff, and of the change process in universities leads to a number of conclusions about why past attempts to improve teaching may not have been as successful as hoped.

First, the problem of improving teaching is extraordinarily complex. Complexity is inherent in the organizational character of universities and in the characteristics of academic staff and their work. Second, the attempts made to deal with the teaching problem are novel. The major responses to improving teaching did not come until the early-mid 1970s. Third, there was - and still is - a weak theoretical and knowledge base for action and, finally, the focus on developing individuals may not have been the best focus for teaching improvement strategies.

Robert Cannon has been burrowing away into the political and educational fabric of the University of Adelaide for the past eight years in the hope that significant changes in the quality of teaching, learning and educational practice might occur. However, his university experience and his reflections on the political and economic circumstances of Australian higher education more generally, have taught him that significant change will probably only occur on a geological time scale. Aside from operating as an agent of change, he holds the degrees of M.A.(Syd), M.Ed. Admin., Dip.Tert.Ed. (NE), and is Director of the Advisory Centre for University Education.

Address for Correspondence: Dr. R. Cannon, A.C.U.E., The University of Adelaide, G.P.O. Box 498, Adelaide 5001 South Australia.

Teaching is the major professional activity of academic staff in Australian universities (1). Much disquiet about the quality of this teaching has been expressed. This disquiet has been accompanied by formal recommendations from government sponsored committees of enquiry and from commissions, that teaching should be improved. The persistence of disquiet, from the Murray Report in 1957 to the present, suggests that efforts to improve the quality of university teaching have not been altogether successful.

The importance of quality in university teaching is reflected in the comment of Emeritus Professor Sir John Crawford, Chancellor of the Australian National University, who said that the standard of teaching in universities is probably the most important single issue in the public's attitude to universities (Australian Vice-Chancellors' Committee, 1979). The existence of concern for the standard of university teaching is a most serious problem. Universities provide the highest levels of education available, insist on their own excellence in teaching and research and demand of both their staff and their students the highest standards of prerequisite qualifications for membership. Yet, in spite of assertions of excellence, there is an element of low quality teaching. In its Report to the Prime Minister, the Committee of Enquiry into Education and Training (the 'Williams Report') felt obliged to recommend:

> ... that the Australian Vice-Chancellors' Committee appoint an expert Working Party to formulate programs for staff in the theory andpractice of teaching, curriculum development and examining, and then later consider whether satisfactory participation in such programs should become a normal condition of tenured appointment. (Education, Training and Employment, 1979, 200)

This recommendation was acted on, and a report on academic staff development was prepared by a Working Party and published by the Australian Vice-Chancellors' Committee (1981). The Working Party recognized a need to give greater attention to making the university environment more receptive to professional development ideas. These ideas are, essentially, those contained in its Recommendation 2:

- a programme of induction for new staff;
- explicit procedures for advising staff on their performance; and
- a formal evaluation programme for all staff.

To make the university environment more receptive, the following mechanisms are advocated:

- a review of appointment and tenure conditions;
- reduced loads for all staff in the first year of their probation;
- introduction of incentive programmes or reward structures to encourage effective teaching.

Two further recommendations are made to facilitate the achievement of the receptive environment. These are recommendations supporting staff development units and the role of the Australian Vice-Chancellors' Committee and the Federation of Australian Universities Staff Associations in the formulation of salary policies.

These recommendations are, on balance, a considerable act of faith. The Working Party noted the paucity of evidence to support the notion that professional development improves university teaching and was prepared to accept essentially anecdotal evidence that professional development activities are helpful to those participating in them.

The purpose of this paper is to explore some of the reasons why it is that after nearly thirty years of recommendations and comment on the inadequacies of university teaching that it is still necessary to act on faith rather then on evidence, and why it is that university teaching has not responded to these recommendations. Three reasons are advanced for discussion. They are:

- that there has been a failure to fully appreciate the distinctive organizational characteristics of universities;
- that the characteristics, attitudes, and work patterns of academic staff are imperfectly understood; and
- that the forces of change to improve teaching have been weak.

This is not intended as an indictment of professional development or of those who have sought changes and improvement in teaching. Rather, it is a modest contribution to the construction of an adequate theoretical basis for professional development in Australian universities. The absence of this theoretical basis might well be listed as a fourth reason why professional development is still largely an act of faith.

ORGANIZATIONAL CHARACTERISTICS OF UNIVERSITIES

Universities are distinctive and complex organizations. Baldridge (1978) has described this distinctiveness in terms of five major organizational characteristics: organizational goals, the client -serving nature of universities, a problematic technology of teaching and research, professional staff and a considerable vulnerability to the wider cultural, political and economic environment.

An essential step toward understanding the distinctiveness and complexity of universities is the creation of a conceptual framework within which characteristics can be ordered and related to each other. Such a framework is provided by open-systems theory (Thomas and Browne, 1969). A fundamental property of an organizational system is that it is made up of subsystems. The relationships between these subsystems and the way in which they give order to the whole characterise the system. These relationships can be considered at two levels of analysis: first, the system's relationship with its external environment and, second, the relationship of the subsystems within the internal environment of the organization. In the case of a university, relationship with the external environment is illustrated by political and legal matters, finance, students, and by the community's dependence on the university for trained and educated manpower. Relationships within the internal environment of the University are illustrated by the sharing of facilities and staff, and by the centralization of certain services such as libraries, computing and administration. Figure 1 illustrates this complexity.

Another useful idea in understanding the university as an organization comes from an extension of the open-systems concept known as contingency theory. Contingency theory analyses the internal adjustments of an organization as it attempts to meet the changing demands of its external and internal environment (Hanson, 1979). The theory suggests that organizations, such as universities, with uncertain and diverse environments tend to be composed of integrated and differentiated subsystems to help achieve efficiency and effectiveness in the operation of the organization. Integration refers to the extent to which the subsystems co-operate to achieve the general purposes of the organization. Integration is critical: it is represented in universities by administrative procedures, the sharing of information, openness of communication, and co-operation between subsystems. In universities, a major integrating mechanism is the committee. Differentiation is another crucial concept. A university's teaching departments, library, administration, computing centre and teaching unit are differentiated from each other in terms of their distinctive tasks, organizational structure, technology of work, and people. Differentiation arises because the subsystems face different environments and different tasks. These differences are clearly illustrated, for example, when the university administration is contrasted with, say, its classics department.

The systems idea of differentiation is related to each of the university characteristics enumerated by Baldridge. There is differentiation of goals between disciplines, the clients served by the university - the students - are differentiated (and becoming increasingly so); there are distinctively different technologies of teaching and research among academic departments; the academic staff of universities are differentiated in terms of their attitudes, skills and backgrounds, and academic departments face a wide range of differentiated external environments. Thus, the university needs to be considered as an internally differentiated or heterogeneous organization for the purposes of discussing professional development.

The internal complexity of universities needs to be considered in relation to external complexity as well. In the external environment there is a web of interdependent organizations (Perrow, 1979). The dynamics of organizations can be seriously misunderstood unless this web is considered. For the contemporary Australian university, this web may include other universities, state education departments, state tertiary co-ordinating bodies, public examination authorities, tertiary admissions centres, colleges, teaching hospitals, professional associations and so on. The dynamics of university organization would be seriously misunderstood if consideration of the

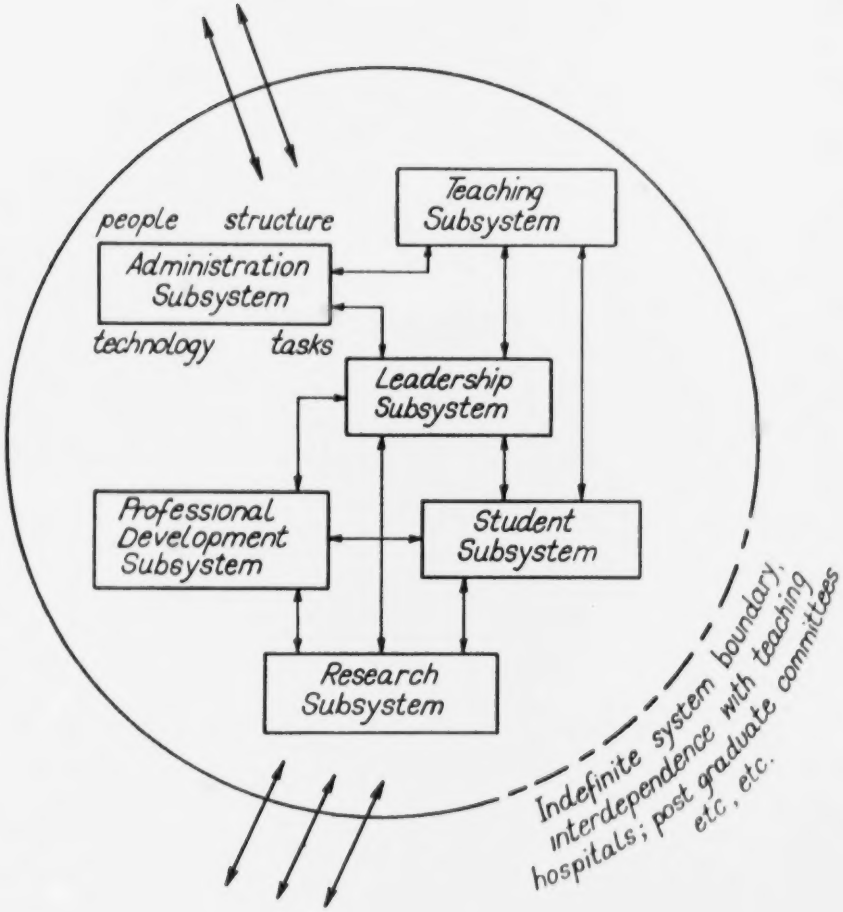

FIGURE 1: Organizational Complexity in a University

external environment were simply left at the relationships between different organizations. For universities, the relationship between individuals, departments, and faculties in other universities is often more important, stronger, and more active than intra-university relationships. This is the idea of 'the invisible college'. It illustrates Gouldner's idea that organizational members were, to use his term, 'cosmopolitans' - owing stronger allegiance to colleagues elsewhere than to their own universities (Australian Vice-Chancellors' Committee, 1979).

This is an important point which has often been overlooked by professional developers and advocates of change in teaching in the universities. HERDSA, for example, has stressed the responsibility of institutions for professional development and has, with one exception, suggested guidelines which ignore the 'invisible college' concept (HERDSA, 1980). The exception, curiously enough, has to do with providing regional and national programmes for professional developers. Past attempts at professional development have tended towards closed-system thinking - that is, to concentrate on individual academic staff in separate universities rather than considering the relationships between universities as parts of a much larger system of university education embracing more than just isolated institutions.

This analysis of organizational characteristics has sought to illustrate the complexity of the university. The goals of universities, it has been suggested, lack clarity. This characteristic is exacerbated to the extent that the goals of individual academics, departments and faculties may be at cross purposes. Indeed, to the extent that academics demonstrate cosmopolitanism, it is probable that their identification with some of the goals expressed by the university will be weak. Accordingly, and in view of the strength of the autonomous tradition and notions of academic freedom in the Australian university, it can be argued that even if the universities had unambiguously declared their goal of pursuing excellence in teaching through professional development, this goal would not necessarily be shared or pursued by academic staff within each subsystem of the University.

ACADEMIC STAFF: SOME CHARACTERISTICS

In the previous discussion, the idea of differentiation was introduced to illustrate the complexity of the university. Among the differentiating features of the university are its academic staff. Staff characteristics are, of course, crucial in any consideration of professional development for it is they, after all, that are the usual focus of concern.

Staff can be described in terms of a number of differentiating criteria, each of which has potential implications for professional development. Age is one such criterion. Chickering and Havighurst (1980) have argued that adults - like adolescents - face a number of different developmental tasks at different ages. Thus, those academics in their early adult years are likely to be concerned with the instrumental aspects of education such as developing a basic repetoire of skills and integrating experience with their academic study. Academics in what they call the 'mid life' transition (35-45 years) can be considered likely to place importance on educational methods which build on their existing competencies rather than, perhaps, embarking on new academic developments which might be tried out in the middle-adult years (45-57). Whatever the tasks facing the adult, it is important to recognize that different developmental tasks are being faced and that these tasks differ qualitatively with age.

There is evidence that strong relationships exist between field of teaching and attitudes to teaching and learning. In a British study, Halsey and Trow found strongest interest in teaching among social science staff and weaker interest among staff in natural science disciplines (Halsey and Trow, 1971). Gamson (1966) reported that staff belief systems centred on two attitudes, or 'orientations', toward objectives and staff-student relations. One attitude that she termed 'normative' was generally characteristic of social scientists. This attitude viewed the development of the student as a person and as a scholar to be most important. The other attitude -utilitarian - and generally held by natural scientists - focused on the importance of subject matter. Morstain and Smart (1976) found similar attitudes and also a link with teaching methods: humanities and social science staff tended to have more desire to share in educational decision-making with students and to favour more individually tailored teaching and learning arrangements. Science and engineering staff tended to be more formal and were characterized by their use of more structured lecture-type teaching.

Why do these differences among staff occur? Recent work on academic developmental stages throws some light on to this question. Development implies dealing with experience in increasingly sophisticated and complex ways and being able to integrate this complexity into stable intellectual structures. Developmental theorists look at how an individual thinks about matters rather than what he thinks (Perry, 1970; Freedman, 1979). Using interview data, Freedman and his associates were able to place a sample of American academic staff along a continuum according to the complexity of assumptions that underlay the meaning they gave to their professional lives. Views concerning the process of education, conceptions of the nature of knowledge, philosophy of teaching, professional roles, relation to their discipline and attitudes to colleagues and to students were analysed. Sorting academics along the continuum gave five stages.

Freedman also examined the relationship between the five stages and academic disciplines. He found important and significant differences between humanities-social science academics and science-professional academics. These differences include the following:

- on average, the humanities and social science group see their discipline in more problematic terms;
- humanities-social science groups have a less dualistic, good and bad view of human nature.

For the present, it is sufficient to recognize that important differences between fields of teaching do occur. This knowledge may be useful in arranging professional development programme design.

Academic staff can be differentiated in terms of other criteria as well. Stylistic criteria are important. Stylistic differences including cognitive style, learning style and teaching style. Several of these styles also tend to be closely related with disciplines. For example, the cognitive style of field dependence (approaching situations in a global way) characterizes teachers of the social sciences and humanities whereas field independence (approaching situations analytically) characterizes teachers of the nature sciences.

It needs to be recognized just how different individual teachers can be, and how potentially important these differences can be in considering professional development activities. The apparent failure of past attempts to improve teaching might be attributed, in part, to a lack of attention to these differences.

FORCES OF CHANGE TO IMPROVE TEACHING

This paper commenced by referring to disquiet about university teaching made as far back as the historic Murray Report of 1957. In the quarter century since those criticisms, what changes to teaching have been made? Can a review of these changes indicate suitable mechanisms for future change?

At the university systems level, there has been a continuing expression of support for quality in university teaching. This support commenced with Murray and continued in the reports of the Australian Universities Commission and its successor, the Tertiary Education Commission. The rhetoric has been given flesh and blood in several ways. The most visible of these is the creation of special units or centres in most universities whose task it is to help improve the quality of teaching. Other changes include the availability of postgraduate programmes for university teachers offered, for example, those offered by the University of New England. These changes have themselves stimulated other changes. The establishment, staffing and productivity of teaching units has contributed to the pool of knowledge about professional development and about university education. Practices have been devised, implemented and evaluated (Stanton, 1978; Cannon, 1979; Meyer, 1979).

Particular educational concerns have also been addressed. Examples include medical education policies (Sheldrake, et al, 1978), evaluation in medical education (Newble, 1977) the phenomenon of mature-age students (Hore and West, 1980) and the efficacy of teaching methods (Powell, 1974; Brewer, 1977).

Professional societies concerned with university teaching have emerged. The most broadly based among these is the Higher Education Research and Development Society of Australasia (HERDSA). Another broad change has been the diversification of university education. Diversification exists in many forms: the student population has diversified as a result of more liberal admissions policies; teaching methods reflect the availability of new audio-visual and computing technologies, and new methods such as individualized instruction are further illustrations of diversification. These are some of the changes in teaching and in teaching-support facilities that have been achieved in the quarter century. At the same time as many of these teaching changes were being put into effect, the universities were growing at the most rapid rate since their establishment. This meant that financial resources for change and development were relatively easy to obtain. It also meant that large numbers of new staff with new ideas were entering the academic workforce.

What insights into the change process can these changes give? First, they illustrate the important role of external stimulants to change. Second, they reveal the importance of the concept of interdependence between institutions, their members, and the wider professional, social, economic and cultural environment. Third, technological change is also illustrated: both the hardware technologies of equipment and software technologies of instructional design. The crucial role of the organization and the political and economic climate must be noted. Warren Bennis has observed that too much emphasis has been placed on the role of individuals in the change process and not enough on the wider setting that the individual was in. (Bennis, 1966)

In evaluating change in Swedish higher education, Berg and Ostergren observed that all changes in the content and method of higher education they studied were related to factors in the external environment of universities (Berg and Ostergren, 1977). Change in Australian universities has also been related to the external influence, particularly to the influence of the educational and financial policies of governments. However, there is an inherent weakness in this change process insofar as teaching is concerned.

E.H. Schein observed that:

> Studies of the change process consistently come up with one key finding: if change is to be accepted and to become part of the regular system, the parties to be changed must be involved early in the diagnostic and change planning process. In other words, once an entry system has been selected, the first step most likely to succeed is to involve the entry system in some of the same diagnostic procedures that the change agent has already gone through rather than confronting the entry system with a proposal or recommendation. (Schein, 1972, 93, emphasis added)

Schein argues that such involvement ensures reliable implementation of changes because the change programme is seen to belong to the change target system rather than something imposed from outside. Berg and Ostergren reached similar conclusions:

> One condition for meaningful change is that all levels of the higher education system are given opportunity to critically evaluate all potential changes. (Berg and Ostergren, 1977, 126)

One of the major weaknesses in bringing about change and development in the teaching role is that the 'change targets' - the university teachers - are infrequently involved, or indeed, consulted. This is true for the recommendations produced by the AVCC Working Party. Certainly the Working Party sees its recommendations as intending to provoke discussion, but the crucial matter is that university teaching staff were not involved in contributing to the development of the recommendations now proposing changes in their teaching roles and reward systems.

THEORY AND PROFESSIONAL DEVELOPMENT

The successful practice of professional development in universities in the future will depend on the development of an adequate theoretical basis to inform practice.

Theories are characterized by propositions which guide thinking, research and professional action in education. Propositions are a starting point for research, a goal of which is a contribution to the further development and refinement of theory. Theory enables explanation, prediction and informed action to take place. An end-point to all this is better understanding and influence over the process of professional development.

There is no well-formulated general theory of professional development at this time. In the absence of an adequate general theory of professional development, professional developers must draw on other theories to inform their practice. Learning theory and organization theory are two bodies of existing theory which are particularly relevant to professional development: learning theory, because of its focus on the individual, and organization theory because of its capabilities of bringing order to the organizational complexity of the university, its members, and the environments of both.

Organization theory suggests the following relevant statements for a theoretical formulation of professional development in universities. The statements refer particularly to that subsystem of the university - the teaching unit - which carries out the policies, practices and programmes directed at the skills, knowledge and attitudes of teaching staff.

1. *Professional development is influenced by events and forces from both the internal environment of the university and from the external environment.*

The organizational complexity of the university has been noted. Part of that complexity is the university's vulnerability to the external environment. The teaching unit is subject to similar kinds of influences from the external environment as the university, either directly or indirectly. These influences come from the cultural, political, legal, economic, information and technical, and physical environment.

Some examples of these influences are:

Cultural influences

Community standards and expectations of academic quality and excellence; the extent to which values such as autonomy and academic freedom are sustained in the community.

Political and legal influences

Government endorsement of the recommendations of committees and commissions - for example, the lists of evaluative criteria in the Williams Report; government acceptance or rejection of financial recommendations of the Commonwealth Tertiary Education Commission; industrial laws governing the conditions of employment of staff; the recommendations and political activities of the Australian Vice-Chancellors' Committee and other bodies; copyright legislation; industrial agreements and industrial actions.

Economic influences

University financial arrangements, the extent to which reduction in public funding can be countered by private financial arrangements; imposition of fees; changing employment markets; student demand for university places.

Information-technical influences

Growth in knowledge, the ways in which theory and research contribute to changes in professional practice (e.g. of professional development), developments in communication technologies which can restructure teaching and learning arrangements.

Physical influences

Geographical location of educational activities, with respect to students and employment opportunities; climatic influences on certain kinds of educational programmes such as agriculture, civil engineering and forestry.

Some of these influences are felt less directly by the teaching unit because they are dampened by the university. The teaching unit is also subject to forces from the internal environment. Internal political and economic forces, for example, can determine whether a teaching unit exists at all and, if so, the scale of the activity. More subtle, and complex forces are created internally by the interaction of the distinctive tasks, technologies, structures and staff of other departments within the universities.

2. *Effective teaching units use information available in the internal and external environment and respond to the forces and events in these environments.*

The environments of the teaching unit contain a wealth of information relative to their functioning. This information is both contextual and professional. Contextual information refers to economic and political matters which directly influence the

character and functioning of universities and of the teaching unit. Professional information refers to the body of knowledge about professional development, and teaching and learning in higher education. Responses to information can be either active - in which case the teaching unit uses the information for some purpose, or it can be inactive - in this case the subsystem deliberately chooses to ignore the information. Obtaining information depends to a large extent on statements 3 and 4.

3. *Within the differentiated university environment, the character of integration between the teaching unit and other subsystems will be crucial to successful functioning.*

Integration may be achieved through the participation of the teaching unit in the activities of the university, the sharing of resources and administrative integration to the extent that the teaching unit is connected to the policy making machinery of the university. The quality of this integration reflects such matters as the administrative location of the unit in the university.

4. *Professional development is enhanced to the extent that the contribution of each subsystem to the whole and its relationship with other subsystems and with the external environment is understood by the teaching unit and incorporated into the unit's practice.*

Knowledge about the complex functioning of the university and of its subsystems enhances professional development activities because it enables better-informed decisions to be taken about programme design, and about obtaining and using resources in the environment. It enables the bringing together of groups inside and outside the university for specific professional development activities. In these roles, the professional developer is acting as an information broker and as a'facilitator'.

5. *Technology creates opportunities and challenges with respect to professional development.*

Educational technologies provide rich opportunities to develop teaching and learning practices. The videocassette, sound cassette and computer are three obvious examples. The characteristic ways of teaching in different disciplines - the discipline-related technology of teaching - will have profound implications for the relevance and application of such hardware technologies.

6. *Professional development is interdependent with other subsystems of the university and with other organizational systems and subsystems in the external environment.*

In summary, the whole enterprise of professional development is inextricably linked with the internal and external environment of the university. For universities the external environment is especially important in professional development, and has been underused in the past. The strengths of links between academic staff in different universities suggests that positive outcomes for professional development may be derived from exploiting these links and sponsoring activities which permit the sharing of information and resources among disciplines in different universities.

CONCLUSION

The analysis of why university teaching has not responded readily to attempts to improve it was based on reasons advanced in the introduction. Each of these reasons has been addressed in the preceding pages. The analysis suggests five conclusions about professional development for university teachers.

1. The problem is extraordinarily complex

An analysis of universities as organizations shows the extent of internal differentiation with respect to tasks performed, membership and technology. Academic staff display a wide range of complex differences: differences between themselves and other professional groups in society, and among themselves in their styles, stages of development, disciplines and attitudes to teaching.

2. Attempts to solve the problem are novel

It was not until the early '60s that persistent demands to improve university teaching were heard. The response to the demand was not immediate; some institutions ran short courses in teaching and a few experiments in teaching were conducted. The major response to the developing pressures to improve teaching did not come until the 1970s: ten of the sixteen staff development units now in existence were not established until 1973 or later.

3. There was, and still is, a weak theoretical and knowledge base for action

The creation of teaching units was very much an act of faith. Knowledge about university teaching at the time was meagre and largely superficial. Some faith had been placed in educational technology, both in its 'scientific' approaches to the design of instruction and in the use of hardware, especially television. The research basis for action was missing. Worse, the theoretical basis for both action and for research was almost non-existent or, in the case of educational technology, inappropriate. (Nunan, 1981)

The knowledge basis is weak in four important areas: universities and their functioning; academic staff characteristics; teaching methodologies and evaluation procedures, and in the mechanisms of institutional innovation and change.

4. The resource base for change was limited

The major institutional change towards improving teaching - the creation of teaching units - occurred just before or at the time of the cessation of a period of exceptional university growth. This meant that resources available to improve teaching were constrained when growth may have been both desirable and beneficial. The slow-down has had another important effect in that teachers now find their loads increasing with resulting less time available for professional development activities.

5. Is professional development the best focus for improvement strategies?

In view of the equivocal success of professional development in the past, is it now the best focus for development activities? Distinctions can be drawn between professional development, instructional development and organizational development. The question that should be asked now is should more emphasis, and priority, be placed on developing the organization and improving the institutional environment for teaching and learning? This question is one that needs careful consideration by educational administrators responsible for the application of very scarce resources to the task of improving the general quality of university education as distinct from the quality of university teaching.

NOTES

(1) Data collected from the Williams Inquiry in 1977 shows that in a sample of 1403 Australian academic staff, face-to-face teaching and teaching related activities such as preparation and marking, occupied 53% of the working week. Research took 25% of time and administration 14%. See: Cannon, R.A. (1981) Professional Development of University Teachers: an Act of Faith? Armidale, The University of New England (unpublished M.Ed.Admin. dissertation).

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Staff Development—The Problem and Some Possible Solutions

R.B. Gardiner
Queensland Institute of Technology

ABSTRACT

The present crisis in education has served to emphasise the need for tertiary institutions to implement realistic staff development programs. However, it may be difficult to convince university and college authorities that scarce resources should be diverted to these ends, particularly when the problem of assessing the efficacy of such programs is acknowledged.

After stressing the desirability of adopting a broad interpretation of the term "staff development", it is suggested that three distinct approaches may be helpful: (i) strive to ensure that staff perceive their activities to be relevant to and in tune with community needs, (ii) maximise flexibility in the staffing area, (iii) minimise causes of insecurity and low self-esteem amongst staff. In developing these suggestions, comparisons are made between university and college sectors and it is contended that, in certain areas, the former may have something to learn from the latter.

R.B. Gardiner, M.A., B.Sc., Ph.D.(Edin.) has been Head of the school of Applied Science since 1980. Following teaching positions at the Universities of Edinburgh and Glasgow, he moved to a senior lectureship in physics at the University of Queensland in 1969, and was a Fulbright Senior Scholar at the University of Arizona in 1976.

Address for Correspondence: Dr. R.B. Gardiner, Head, School of Applied Science, Queensland Institute of Technology, G.P.O. Box 2434 Brisbane 4001 Queensland.

THE PROBLEM

The morale of academic staff in Australian tertiary institutions is widely acknowledged to be threatened at present by a number of related factors, including low job mobility; poor promotion prospects; reduced levels of support for teaching, research and administration; intense competition in many areas of activity; increased "bureaucracy" and "government interference"; and - perhaps the most insidious of all - the relentlessly increasing average age of colleagues.

The need for effective staff development programs has gained wide acceptance recently in both university and college sectors (see, for example, Lonsdale (1980); HERDSA (1980); AVCC (1981); Lonsdale & Bardsley (1982)). Nevertheless, there has been a notable reluctance on the part of most institutions to earmark scarce resources for the implementation of such programs, in spite of the substantial benefits which would probably accrue from even a modest investment. There is little likelihood of this situation changing unless and until staff development is accorded, by the academic community, a priority which is comparable to that of more traditional activities.

The main impediment to increasing the acceptability of any staff development program is the difficulty of assessing its efficacy. In each of the four broad areas into which staff development is conventionally divided - teaching, research and scholarship, administration, community involvement - no well-accepted mechanisms exist for evaluating accurately a staff member's performance. In particular, to quote from West et al.(1980), we should reject

> "the common folklore that research is easy to evaluate but teaching is not (p.36) ....Teaching is hard to evaluate but, we submit, it is no harder to evaluate than research (p.37)".

It is inevitable, therefore, that efforts to detect and measure changes in performance, using presently available techniques, are of questionable validity; hence, any data which may be advanced in support of the therapeutic effects of staff development programs will, in all probability, lack sufficient rigour to convert the sceptic.

POSSIBLE SOLUTIONS

In view of the manifest problems associated with sponsoring and monitoring staff development programs in an unsupportive atmosphere, what strategies should a tertiary institution adopt? A useful first step is to recognise that each staff member is an individual, characterised by a unique blend of strengths, weaknesses, needs, aspirations and interests. Thus, any serious approach to staff development should cater for a broad spectrum of activities, and should be flexible enough to allow each staff member to select according to his or her requirements. Application of an undifferentiated policy to everyone will, in all probability, lead to what might be termed "the mediocrity of comprehensiveness".

More specifically, the institution could endeavour to:

1. Ensure the Relevance of its Programs

It should be appreciated that morale will be increased if the activities in which staff are engaged are judged by the community at large to be "relevant" and "useful". With reference to courses offered by the institution, attainment of this objective may be facilitated by establishing for each course (or group of cognate courses) an advisory committee - with a substantial fraction of its membership drawn from employers (or potential employers) of graduates from the course - to review the course regularly; and by maintaining contact with graduates and soliciting their opinions on course development. Another relatively inoffensive form of course evaluation which may merit closer attention is the extension to undergraduate courses of the external examiner system: this, after all, constitutes a mandatory part of postgraduate programs, where its utility is accepted without question.

Additionally, academic staff could be encouraged to engage in relevant consultancy, and in mission-oriented research and development, in close collaboration with industry (used here in its broadest sense). Inducements could be offered to staff to spend special studies/professional experience programs in industry, rather than in an academic

environment. A staff exchange program with industry could be established, and the possibility investigated of joint industry/institutional appointments.

2. Maximise Flexibility with regard to Staffing

The effectiveness of existing academic staff could be enhanced by recommending to selected personnel that they should acquire additional skills (for example, in computer applications, management, interpersonal relations). In extreme cases, substantial in-service retraining could be encouraged, enabling staff to be re-deployed in areas of greater need: thus, a mathematician or physicist might undertake a graduate course in computer science.

The staffing profile in each department should, perhaps, be required to tend towards an agreed norm, thereby preventing the inefficient and retrogressive "top-heaviness" which is exhibited by many long-established departments. In addition, merit bars could be established within each grade to inhibit "incremental creep", along with the development of a set of clearly enunciated criteria for advancement beyond each bar.

Further flexibility in the area of academic staffing would be achieved if some fraction (say about 15%) of positions were to be filled by appropriately qualified part-time staff. Where such staff are appointed because of their specialised expertise, they are likely to add a "real world" flavour which, otherwise, might be lacking in an academic department.

Meaningful criteria for confirming appointments should be established, and the performance of a probationary member of staff should be monitored at regular intervals. If inadequacies are detected, remedial courses of action should be made available, and should be taken forthwith. Appointments should be confirmed only after a careful evaluation has been undertaken of a probationary staff member's performance over a lengthy period. At the other end of the time-scale, a range of early retirement options might be developed.

Finally, all possible steps should be taken to attract funding to the institution from external sources. To this end, inexperienced staff should be offered advice on how to seek support from grant-giving agencies. In particular, external funding could be applied to meet the cost of satisfying the greatest need felt by many academic staff - the need for a graduate student or research assistant.

3. Minimise Feelings of Insecurity and Inadequacy

The institution should acknowledge freely that staff are not expected to make equally substantial contributions in all areas of institutional activity. On request, feedback should be available to staff on the institution's perception of their performance, and assistance in appropriate areas of staff development should be available to those who seek it.

As mentioned earlier, unrealistic expectations of promotion - always a most contentious issue - should be avoided through a system of establishment and merit bars; relaxation of the former should be permitted only in exceptional circumstances. An open-ended system of promotion is not only unrealistic, but involves the dissipation of valuable staff time (in preparing and assessing applications and referees' reports). It tends to produce acrimony and discord between staff, resulting in a loss of self-esteem and job satisfaction.

CONCLUDING REMARKS

In many ways, problems in the area of staff development in colleges are similar to those in universities. One significant difference, however, is the strong commitment in the latter to research and scholarship: all university academic staff are expected to be productive in this area, and few (if any) constraints are imposed on the type of research which is prosecuted. However, for the university staff member who is not strongly research-oriented, or whose research is unsatisfying, the provision of appropriate

professional development opportunities can pose very real problems.

The strong vocational orientation of college courses, coupled with a system of regular course accreditation involving advisory committees (on which industry is strongly represented), encourages a close and mutually beneficial interaction between college staff and industry - the employers of graduates. Further community involvement through consultancy and continuing education activities is frequently available to interested staff. In addition, the emphasis placed by many colleges on fostering teaching excellence is in marked contrast to the relative neglect of this activity in most universities, although the teaching loads in the two sectors are comparable.

Thus, by de-emphasising the primacy of research and by encouraging good teaching and effective industrial and community involvement, colleges should be better placed than universities to promote staff development. Furthermore, the willingness of colleges to involve significant numbers of part-time staff in their activities promotes ongoing "real world" interaction, as well as affording greater flexibility to re-deploy resources in response to changing needs. On the other hand, universities are probably more demanding in the area of appointing new academic staff, and in requiring a realistic probationary period to be served before an appointment is confirmed.

When a tertiary institution is provided with funding for a substantial new facility - perhaps a building, or an expensive piece of equipment - great care will be taken to make the best possible purchase with the available funds. The installation will then be subjected to rigorous testing before it is accepted, and adequate provision will be made in financial planning for servicing and maintenance of the facility in the years ahead.

There can be no doubt that the most important investment made by any tertiary institution is in its academic staff. It follows, therefore, that each academic staff member should be selected with care, and should be confirmed in his or her appointment only when appropriate "acceptance trials" have been completed successfully. However, it is with respect to the third stage, namely the equivalent of after-sales servicing, that institutions are most likely to neglect their major asset. At a time when the educational climate is becoming increasingly corrosive, failure to provide adequate preventive maintenance in the form of staff development programs is both irresponsible and imprudent.

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The Receptivity of Australian University Teachers Towards Academic Staff Development Programs Focusing on the Teaching Role

J.M. Genn
University of Queensland

ABSTRACT

Following the recent report of the Australian Vice-Chancellors' Committee (AVCC) Working Party on Academic Staff Development, it is highly likely that many programs to foster staff development will soon be launched or up-graded. The research basis for such programs is unfortunately sometimes not as strong as the polemical and rhetorical base. The research reported in this paper is concerned with the receptivity of Australian university teachers towards academic staff development programs focusing on the teaching role, and may provide a timely and helpful information base to guide program planners. On the basis of educational theory it is postulated that if five specified factors are not fully operational, a university teacher's learning about university teaching and its improvement will not occur or will be less likely to occur. It is hypothesised that the extent to which each of these factors is operational is substantially limited for substantial numbers of university teachers, and that deficiency in the operation of these factors will vary according to the university and departmental affiliation, status, sex, age and prior school-teaching experience. This hypothesising is tested and confirmed, via the analysis of data provided by nearly 800 Australian university teachers.

J.M. Genn, B.Sc., B.A., B.Ed., Ph.D.(Q'ld) is a Senior Lecturer in Education. He has been a Fulbright Senior Scholar and a Visiting Professor at the University of California at Los Angeles and a Visiting Lecturer at the University of Dundee, Scotland. His book, Pursuit of Excellence in University Teaching in Australia, is based on a research study supported by the Australian Vice-Chancellors' Committee, and has been published by HERDSA (Higher Education Research and Development Society of Australasia).

Address for Correspondence: Dr. J.M. Genn, School of Education, University of Queensland St. Lucia 4067 Queensland.

CONTEXT AND AIMS OF THE STUDY

The study and its findings are a response to the recently published Report of the Australian Vice Chancellors' Committee (AVCC) Working Party on Academic Staff Development (AVCC, 1981) and are based on data gathered in a research study, supported by the AVCC, of university teaching in Australia (Genn, 1981).

The AVCC Working Party Report has made a number of recommendations concerning the need for and implementation of academic staff development programs aimed at helping university teachers to increase their ability and improve their performance in the various aspects of the academic role. Much emphasis is on the teaching role and its improvement, and particularly the undergraduate teaching role.

The AVCC Working Party Report is not strongly research based, and does not claim to be, being stronger on exhortation, polemics and rhetoric, as is appropriate for a document aiming to produce discussion or debate. The fact is that the research base for academic staff development programs, for teaching or any other academic functions, is not strong. However, such a base is greatly needed if what amounts to a massive intervention program, affecting academics and their students and the nature of the university as an institution, is to be planned and executed in a way that does not invalidate the program or harm the academics, their students or the university. It is in the context of this burgeoning and rapidly accelerating movement, flying somewhat blindly towards the goal of improving universities by "developing" academic staff, that research findings concerning the development of academics as teachers are provided here.

The aim of the study is to provide information about how university teachers see and approach teaching and the teaching role, about their stance towards the improvability of teaching and towards some commonly advanced ways of improving teaching. Such information will indicate areas and issues on which programs aimed at developing and improving academics as teachers might expect either the assistance or resistance of the university teachers, and will also indicate what kinds of university teachers, (according to their university and departmental affiliation, status, sex, age and prior experience as a school teacher), are likely to offer what kinds of assistance or resistance. Such information will initially complicate the work of planners of programs focused on the development of the teaching role but should, in the long run, facilitate and improve such programs and make them more realistic and more likely to succeed.

THEORETICAL FOUNDATION

Persons planning and implementing programs aimed at developing university academics as teachers are themselves teachers teaching teachers about teaching, about the nature of teaching, about attitudes and approaches to teaching, about methods of teaching and methods of improving teaching. As for all teachers, the academic staff developer's task is to foster learning.

Learning theory and teaching theory indicate that learning proceeds most effectively and efficiently when a number of inter-dependent factors are taken cognisance of by the teacher and are concurrently operative in or for the learner. (Hilgard, 1964; Joyce and Weil, 1980; Thorpe and Schmuller, 1954). These factors concern the *structure* of the learning task, the *readiness* of the learner for the task, the *motivation* of the learner towards the achievement of the task, and the *evaluation* or information the learner gets concerning his or her progress, or lack of progress, towards the achievement of the task. *Structure* in the task implies clarity and meaningfulness of goals. Learning about teaching will be difficult if the nature of good teaching is not presented and perceived as possessing a clear, logical, coherent and unambiguous structure. Learning about improving teaching will be difficult if learning about teaching is difficult. Teaching, and particularly good teaching, may be such an unstructured, vague and ill-defined notion that the improvability of teaching is an equally vague and ill-defined goal, and not a real goal at all, for the university teacher. *Readiness* on the part of the university teacher to learn about teaching and its improvement will be a function of the teacher's current cognitive and emotional readiness for such learning. Particularly important is the emotional readiness, or lack of readiness, in the form of positive or negative attitudes towards whatever the development program would have the teachers learn or implement, concerning teaching and its improvement. The *motivation* of the learner towards the achievement of the task is of central significance, and is

a function of the value which the learner attaches to his or her teaching role and its improvement. Value considerations include the value of the teaching role and its improvement, relative to the value of other competing and rival academic roles, and also the value which the learner sees "significant others", especially superiors, ascribing to the teaching role and its improvement. *Evaluation* of the learner's progress in understanding and improving teaching is an essential factor in that progress, but will only be possible if the learner and his or her teachers have a clear idea of the goals, if the learner believes that evaluation strategies to be employed to measure his or her progress towards improvement in teaching are valid and proper, and if the learner is rewarded for steps taken towards improving teaching.

On the basis of the fore-going educational theory it might be postulated that:- the probability of a university teacher, on his or her own initiative, learning to study and improve his or her teaching, or learning to study and improve his or her teaching from the advice, suggestions and teaching of others, will depend on the operation of five factors, viz.

(i) the degree to which the university teacher has a clear idea of what teaching, and particularly good teaching, is

(ii) the degree to which the university teacher believes that teaching is improvable

(iii) the degree to which the university teacher believes that ability in the teaching role is recognised, and that higher status persons, in particular, deem teaching and its improvement to be important

(iv) the degree to which the university teacher esteems the teaching role
- in its own right and
- in relation to other competing or rival academic roles, and

(v) the degree to which the university teacher approves the commonly advanced "recipes" or formulae for "good" teaching, for example such recipes as "Like Your Students (More)", "Respect Your Students (More)", "Listen to Your Students (More)", "Help Your Students (More)", "Understand Your Students (More)" and "Use Innovative and Less Conservative Teaching Strategies (More)" (Eckert, 1973; Schonell et al., 1962; Falk and Kwong Lee Dow, 1971; Nuffield Foundation, 1975; McKeachie, 1969, for example).

Deficiency or difficulty, in the operation of any of the five factors just postulated as correlates of the effectiveness and efficiency of learning about teaching and its improvement, will mean difficulty in understanding and improving teaching for the individual university teacher and difficulty for any one endeavouring to help or teach him or her.

On inductive grounds, from a study of the literature concerning university teaching and its improvement, it might be hypothesised that there are substantial difficulties or deficiencies in the operation of the five factors, for a substantial number of university teachers i.e. there are serious impediments diminishing the likelihood of the teachers' learning changes and improvements in the understanding and practice of teaching.

Further, it might be hypothesised, on the basis of personality theory and theory in social and developmental psychology and sociology, that the extent of difficulties or deficiency, in the operation of the five factors related to effective learning about university teaching and its improvement, will vary according to the individual teacher's university and departmental affiliation, status, sex, age and prior experience or otherwise as a school-teacher. Personality differences among, say, departmental groups or status groups, between the sexes and among the age groups and school-teaching experience groups, almost certainly exist, and these differences, as well as educational and socialisation experiences within the groups, might be hypothesised as determining differences in stances and approaches towards teaching and its improvement.

METHODOLOGY

a. Sampling

The data for the study were provided by 796 university teachers drawn from 10

different kinds of departments (English, French, History, Mathematics, Chemistry, Zoology, Economics, Civil Engineering, Law and Medicine) across six Australian universities. Large and small universities, metropolitan and provincial, new and old, were represented, and departments were selected to cover the spectrum of Arts-Science-Professional. All ranks of teacher (Professor to Tutor) were included in the sampling. Categories were established within the sample on the basis of sex, age (Under 33, 33 to 42, 43 and over), and prior school-teaching experience (no teaching, up to 3 years, more than 3 years).

b. Instrumentation

The data on which this study is based derive from the university teachers' responses to 60 questionnaire items.

Of these items, 52 were broadly concerned with Attitudes to the Teaching Role, and were the basis for the construction of eight scales, named and described as shown below, where the number of items and the coefficient alpha for each scale is also provided. When the findings of the study are presented in Section 4 the kinds of items constituting each scale will be apparent.

Negative attitude to students:	This measures the extent to which teachers hold negative or unfavourable attitudes towards students; 13 items; $\alpha = .77$
Hovering concern:	This measures the extent to which teachers believe they should urge students to work and should accept responsibility for students' progress; 5 items; $\alpha = .46$
Warm:	This measures the extent to which teachers are warmly disposed and friendly towards students; 8 items; $\alpha = .64$
Student evaluations useless:	This measures the extent to which teachers believe that student evaluations of instruction serve no useful purpose; 4 items; $\alpha = .60$
Intangible:	This measures the extent to which teachers believe teaching is an unmeasurable, immeasurable and somewhat existential activity; 5 items; $\alpha = .68$
Non-improvable:	This measures the extent to which teachers believe that there is little that can be done to improve teaching; 11 items; $\alpha = .75$
Conventional strategies:	This measures the extent to which conventional and conservative teaching methods are deemed desirable, by the teachers; 4 items; $\alpha = .62$
Non-recognition of teaching:	This measures the extent to which teachers believe that teaching is not appropriately recognised and rewarded, especially when compared with research and publishing; 2 items; $\alpha = .37$

Five items of information in the questionnaire concerned Role Preferences and derived from one question, viz.

> Please write the numbers 1, 2, 3, 4, 5, respectively, beside the activities that you like or would like best, second best, third best, fourth best and fifth best, in this list:-
>
> * Teaching undergraduate students
> * Supervising thesis work of honours, masters and doctoral students
> * Pursuing your own research and writing

* Administration
* Activities linking university to community

Three items of the questionnaire constituted a Morale:Satisfactions scale, with a coefficient alpha of .68. The actual items will be indicated in the presentation of research findings in Section 4.

c. Statistical Analysis

Simple analyses showed how the 52 items pertaining to Attitudes to the Teaching Role, the five items pertaining to Role Preferences, and the three items pertaining to Morale:Satisfactions, were answered by the sample of teachers as a whole.

Analyses of Variance were focused on each of the eight Attitudes to the Teaching Role scales, each of the five Role Preferences items, and the Morale:Satisfactions scale. The analyses were of a kind that enabled a determination to be made of the extent to which each of the six teacher attributes (university, department, status, sex, age and prior school-teaching experience) is related to a particular scale or item, when control on the other five teacher attributes is exercised (Overall and Klett, 1972). The P = .05 level was used. In these analyses interest centres on conservative estimates of, say, a departmental effect on the "Non-Improvable" scale, or a departmental effect on the Undergraduate Teaching Role Preferences item, when any possibly confounding effects of the other five attributes (of university, status, sex, age, and prior school-teaching experience) are removed, i.e. when departments are effectively equated on these other five attributes.

THE FINDINGS AND THEIR SIGNIFICANCE

a. The Findings

To accord with the structure of the hypothesising in Section 2, the findings from all the analyses are regrouped, in the presentation of findings here, into categories corresponding to the five factors postulated as influential in determining the likelihood that a university teacher will progress in learning about university teaching and its improvement.

Question 1. To what extent have university teachers a clear idea of what teaching, and particularly good teaching is?

Answer

* *54.2% of university teachers in the sample say it is virtually impossible to achieve any consensus with regard to what constitutes good university teaching ("Intangible" Scale).*
* *34.7% say university teachers can only be evaluated in terms of long-term and largely intangible, unmeasurable effects. ("Intangible" Scale).*
* *14.2% say a university teacher's work can only be properly evaluated by the teacher himself or herself. ("Intangible" Scale).*
* *37.9% say a university teacher's colleagues cannot properly evaluate the teacher's work ("Intangible" Scale).*
* *35% say a university teacher's work cannot be properly evaluated by the teacher's superiors ("Intangible" Scale).*
* *19% say the value of obtaining evaluation of university teaching from students is very small, for the teacher ("Student Evaluations Useless" Scale).*

No conservatively estimated differences, for department, status, sex, age, prior school-teaching experience or university, emerged for the "Intangible" Scale.

Question 2. To what extent do university teachers believe that teaching is improvable?

Answer

* *31.6% of university teachers in the sample say that good university teachers are born, not made ("Non-Improvable" Scale).*
* *7.4% say there is little to university teaching except command of the subject ("Non-Improvable" Scale).*

* *41.6% say the value of educational theory for the university teacher is pretty small ("Non-Improvable" Scale).*
* *24.1% say there is too much talk about experimentation and innovation in university teaching ("Non-Improvable" Scale).*
* *24.7% say the value of in-service discussions of ways of improving university teaching is pretty small ("Non-Improvable" Scale).*
* *52.4% say that there should be some form of formal teacher-training and some formal teaching qualification for persons wishing to become members of university academic staffs. ("Non-Improvable" Scale).*

Some interesting results arose in the conservatively estimated differences for university, department, status and school-teaching experience, for the "Non-Improvable" Scale. That university differences existed on this scale was quite remarkable. For departments, the highest scorers on this scale were Chemistry, English and French, and the lowest were Medicine, Civil Engineering and Economics. For status groups, the order on this scale, highest to lowest, was Professors, Senior Lecturers, Readers, Lecturers, Senior Tutors and Tutors. For school-teaching experience groups, the highest on this scale was the "no school-teaching experience" group and the lowest was that with "up to 3 years" school-teaching experience.

Question 3. To what extent do university teachers believe that ability in teaching is recognised, and that higher status persons, in particular, deem teaching and its improvement to be important?

Answer

* *96% of university teachers in the sample say that rewards and promotions are much more likely for research and publication than for teaching. ("Non-Recognition of Teaching" Scale). In this regard see also evidence that corroborates and elaborates this finding (Genn, 1980).*
* *64.1% say there is increasing recognition of the importance of teaching in the university ("Non-Recognition of Teaching" Scale).*

A conservatively estimated difference among status groups emerged for the "Non-Recognition of Teaching" Scale. There was an exact inverse relationship between status and "Non-Recognition of Teaching," with Tutors scoring highest, Professors lowest, and the other groups exactly in place, between. What this means, of course, is that the lower status groups tend not to believe the claims of the higher status groups that they (the higher status groups) do recognise teaching. Recall here that the higher status groups are characterised by stronger beliefs that teaching is "Non-Improvable" than the lower status groups. Note also subsequent findings concerning Role Preferences, where status is almost exactly inversely related to preference for undergraduate teaching (higher the status, lower the preference), and status is almost exactly directly related to preference for research and writing and for thesis supervision (higher the status, higher the preference).

Question 4 To what extent do university teachers esteem the teaching role
- in its own right and
- in relation to other competing or rival academic roles?

Answer

* *93.8% of university teachers in the sample say that undergraduate teaching gives them a good deal of personal satisfaction ("Morale:Satisfactions" Scale).*
* *91.7% say they really enjoy working with undergraduate students ("Morale: Satisfactions" Scale)*
* *61.9% say they are very keen on planning courses and curricula ("Morale: Satisfactions" Scale)*

When it comes to Role Preferences the facts are that:

* *48.5% say that undergraduate teaching is their most preferred role*
* *10.3% say that supervising thesis work of Honours, Masters and Doctoral students is their most preferred role*
* *39.6% say that pursuing their own research and writing is their most preferred role.*

With regard to Morale:Satisfactions, which basically means Morale in undergraduate teaching, only for departments did conservatively estimated differences occur, with English, French and History scoring highest, and Civil Engineering, Mathematics and Medicine scoring lowest.

With regard to Role Preferences, conservatively estimated differences for departments emerged for the undergraduate teaching role, the thesis supervision role, and the research and writing role. The mean preference for the undergraduate teaching role was highest for French, English and Law and lowest for Chemistry, Civil Engineering and Zoology. The mean preference for the thesis supervision role was highest for Chemistry, Zoology and Civil Engineering and lowest for English, Law and Medicine. The mean preference for research and writing was highest for History, Mathematics and Chemistry and lowest for Medicine, Law and Civil Engineering. It has earlier been noted that in conservative estimates of status effects, status was found to be almost exactly inversely related to preference for undergraduate teaching (higher the status, lower the preference) and status was almost exactly directly related to preference for thesis supervision and research and writing (higher the status, higher the preference). In conservative estimate of a sex effect, women were found to have a lower preference for thesis supervision than men. Conservatively estimated age effects showed preference for research and writing to be exactly related, inversely, to age (higher the age, lower the preference).

Question 5. To what extent do university teachers approve the commonly advanced "recipes" or formulae for "good" teaching?

Answer

(Before noting the answers, recall, as has already been mentioned, that it is generally considered a "good thing" for university teachers to like their students, respect them, understand them, listen to them and help them, and there are frequent exhortations to do all these more, in the interests of better teaching. All these "good things" are, of course, aspects of what are generally termed teacher-student relations.)

As for liking students:

- *95.9% of university teachers in the sample say university teachers should strive to achieve friendly relations with their classes ("Warm" Scale).*
- *10.5% say a university teacher needs to be generally somewhat aloof and apart from the students ("Warm" scale)*

As for respecting students:

- *63.1% say students are not interested in learning for its own sake ("Negative Attitude to Students" Scale)*
- *30.3% say students do not make an adequate effort in their studies ("Negative Attitude to Students" Scale)*
- *9.9% say university teachers should exercise more authority over students ("Negative Attitude to Students" Scale)*
- *13.2% say students wouldn't know if a university teacher is any good or not ("Negative Attitude to Students" Scale)*

As for understanding students:

- *69.2% say university teachers need to take account of all psychological needs of students – social and emotional as well as intellectual ("Warm" Scale)*

As for listening to students:

- *70.1% say it isn't reasonable to base curricula largely on students' interests ("Negative Attitude to Students" Scale)*
- *18.6% say students should have no part in framing procedures for the evaluation of their own progress ("Negative Attitude to Students" Scale)*
- *As earlier noted, 19% say the value of obtaining evaluation of university teaching from students is very small, for the teacher ("Student Evaluations Useless" Scale).*

* *51.2% say it would be a very dangerous practice for student evaluations of university teaching to be used in decisions about promotions of academics ("Student Evaluations Useless" Scale).*

As for helping students:

* *40% say students expect too much help from their university teachers ("Negative Attitude to Students" Scale)*
* *84.6% say the onus for learning rests on the student ("Hovering Concern" Scale)*
* *31.7% say it is not the university teacher's responsibility to motivate unmotivated students ("Hovering Concern" Scale)*

Departmental, status, sex, age, school-teaching experience and university effects, on each of the scales broadly concerned with teacher-student relations, viz. "Warm", "Negative Attitude to Students", "Student Evaluations Useless", and "Hovering Concern", were next conservatively estimated. The following interesting findings arose: Departments vary on "Warm", with French, History and Zoology highest, and Civil Engineering, Law and Chemistry lowest. Departments vary on "Negative Attitude to Students", with Chemistry, Law and Mathematics highest, and French, English and History lowest. Departments also vary on "Hovering Concern", with Medicine, Economics and History highest and Civil Engineering, Zoology and Chemistry lowest. The sexes vary on "Negative Attitude to Students", with men higher on this scale. The age groups differ on "Negative Attitude to Students" and "Student Evaluations Useless", with the oldest university teachers scoring highest on each of these scales and the youngest age group lowest. Universities, interestingly, differed on "Negative Attitude to Students", with a high positive correlation between how universities answered this scale and how they answered the "Non-Improvable" Scale.

Recipes or formulae for "good" teaching, as has also been noted in the literature, usually emphasise the need for innovations in teaching methods as well as the improvements in teacher-student relations, of the kind just noted. Amongst "good" methods are often listed discussion and discovery methods and the use of tutorials and seminars, with frequent attacks being made on the lecture as a teaching method.

University teachers responses pertinent to these teaching methods recipes and formulae were:

* *21.5% say the usefulness of discussions and discussion methods as a basis for university teaching is highly over-rated ("Conventional Strategies" Scale).*
* *14% say the usefulness of discovery methods and of students doing research projects at university is highly over-rated ("Conventional Strategies" Scale).*
* *11.4% say the value of tutorials and seminars as teaching procedures is highly over-rated ("Conventional Strategies" Scale).*
* *71.5% say lectures at university are much more valuable than much criticism of them would have you believe ("Conventional Strategies" Scale)*

The outcome of analyses to determine conservatively estimated effects of department, status, sex, age, school-teaching experience and university, on the "Conventional Strategies" Scale, was interesting. Amongst departments, Mathematics, Chemistry and French scored highest on this scale, and Economics, English and History lowest. Men scored significantly higher than women on "Conventional Strategies" and, as for the age effect on "Conventional Strategies", the oldest age group scored highest and the youngest age group lowest.

b. Significance of the Findings

(i) The research findings reported here may contribute to strengthening the research basis on which programs for the development of university academics as teachers are built.

(ii) The findings are timely, following the recommendations of the recent Report of the AVCC Working Party on Academic Staff Development.

(iii) The findings appear to be focused on some vital issues relating to the acceptability and ultimate effectiveness of staff development programs aimed at the improvement of teaching.

(iv) The findings indicate that the framing of suitable academic staff development programs fostering teaching and its improvement will be a complex task, but give some indication of what the complexities are, of particular matters on which either assistance or resistance of academics may be expected, and further indicate which academics are likely to offer what kinds of assistance or resistance.

(v) The instrumentation used to gather these research findings might be used in empirical evaluations of academic staff development programs aimed at the improvement of university teaching.

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Attitudes of Australian Academics to Staff Development

John A. Bowden and John Anwyl
University of Melbourne

ABSTRACT

The publication of the Australian Vice-Chancellors' Committee's Working Party Report on academic staff development has resulted in several public statements by organisations representing academics, viz. FAUSA and HERDSA. In our 1978 national survey of academics (SERVAAC study) we collected information about the attitudes of Australian academics towards staff development and staff development units. Academics are quite supportive of such units and the data for university respondents are discussed with reference to the FAUSA and HERDSA statements and other publications on staff development in universities.

John A. Bowden, B.Sc., Ph.D., Dip.Ed. (Melb.), ARACI, is a Senior Lecturer and Co-ordinator of Institutional Research and Development in the Centre for the Study of Higher Education (CSHE). He previously taught for six years in the School of Chemistry at the University of Melbourne and, since he joined the CSHE in the early 1970s, his major responsibility has been in the provision of staff development courses. He is leader of the Learning Skills Project in the University and a co-author of Learning Skills: A Review of Needs and Services to University Students.

John Anwyl, B.A., B.Ed. (Melb.) is Deputy Chairman of the Centre for the Study of Higher Education at the University of Melbourne. He was previously in the faculty of Education at James Cook University of North Queensland. His interests range from development programmes for university academics to study of national policy in higher education. He has been editor of Vestes since 1978, and has recently edited and written an introductory essay in University-Government Relations: Proceedings of the Conference of University Governing Bodies, for the Australian Vice-Chancellors' Committee.

Address for Correspondence: Dr. John A. Bowden, Centre for the Study of Higher Education, University of Melbourne, Parkville, Australia, 3052.

This paper argues two propositions (1). First, since the relationships between staff developers and their clients are complex, insensitive staff development policies which threaten those relationships should be avoided, otherwise the willingness of academic staff to seek such help will decline; in that event, the units themselves will be at risk. Second, the attitudes of Australian academic staff to staff development units and their role is far more supportive than the literature suggests.

INTRODUCTION

In 1979, the Williams Committee on Education, Training and Employment recommended that the Australian Vice-Chancellors' Committee (AVCC) appoint an expert working party to formulate programmes for staff in the theory and practice of teaching, curriculum development and examining, and to consider whether satisfactory participation in such programmes should become a condition of tenure (Williams Committee, 1979, p 200). The AVCC subsequently set up a Working Party which recommended (AVCC Working Party Report, 1981, p xi), among other things, that:

> "each university should develop a declared staff development policy incorporating a program of induction for new staff members which commences for each staff member on arrival in post, and continues throughout the first year of service. Participation in such programs should be a condition of appointment." (emphasis added by co-authors)

This recommendation was made without discussion of the range of published opinions by Australian and overseas scholars (Foster and Roe, 1979; Harding et al, 1981; Nisbet and McAleese, 1979), that such compulsion would be unacceptable to university academics who would regard it as an infringement of academic freedom.

We test this assertion in the Australian context, drawing on data from our national survey (2) conducted in 1978, titled the 'Social and Educational Role and Values of Australian ACademics' (SERVAAC) study. While we discuss the data only for university respondents, the corresponding data for CAE respondents are given for comparison.

Academics were asked their views on a number of statements (3) concerning the role of staff development units in tertiary institutions: their attitudes to compulsory and voluntary participation in staff development activities (4); their views of the role of staff development units in evaluation of teachers for promotion; and their attitudes to the need for such units. They were asked whether they had participated in staff development activities and responses to the other questions were tested against this. The attitudes to teaching units of participants and non-participants in staff development activities are compared.

SHOULD PARTICIPATION IN INSERVICE COURSES BE COMPULSORY?

Various reasons are advanced against inservice activities being compulsory for all of the teaching staff of tertiary institutions (or for certain sections, as suggested by the AVCC Working Party). Many academics believe they have the right to teach as they choose and to decline to be 'developed'. Also there is a widely-held view among members of staff development units that any element of compulsion could damage their relationship with the academic staff of the institution they serve.

Since 1975, we have had the major responsibility for the planning and presentation of staff development courses in the Centre for the Study of Higher Education (CSHE) at the University of Melbourne. Our view, confirmed by experience over a decade, is that compulsory attendance at such courses is counterproductive. On the few occasions when teaching staff have been 'sent along' to our courses by heads of department (a milder form of compulsion than that proposed by the AVCC Working Party), the outcome has been unfavourable. Such academics tend not to participate fully in the activities of the particular group, their attendance is spasmodic and often ceases before the end of the course. Such membership rarely enhances a group and often impedes its progress. The policy on compulsion we have developed was recently spelt out by our Director in a Report to the CSHE Advisory Board (1982, p 4):

> "It should be noted that some of its (the AVCC Working Group on Staff Development) recommendations are inconsistent with our policies and practices. In particular we would not agree with the suggestion of compulsory participation of certain teaching staff in teaching and learning programmes.
>
> We have found the gradual development of trust over a long period to be a better basis for encouraging people to seek help for the improvement of teaching, and the high rate of participation in the range of activities offered by the Centre for this purpose encourages us to continue with this policy. Over 600 members of the academic staff of the University have participated in our group activities in this area in the past four years and we doubt that as high a rate could be obtained in any institution which used compulsion."

The views of Australian university academics on compulsory attendance at staff development programmes are shown in Table 1. While half the respondents agree that all teachers should take such a course voluntarily, less than one-fifth believe such participation should be compulsory. There is a shift of about forty per cent of respondents who do not disagree with voluntary course participation but who do disagree with compulsion.

The corresponding data for CAE respondents are 42, 16 and 42 per cent respectively for the first statement in Table 1 supporting compulsion, and 62, 19 and 19 per cent respectively on the second statement advising voluntary activities. The shift from one to the other is not nearly so marked for CAE respondents as that noted above for those in universities.

TABLE 1

University teachers' views on compulsory and voluntary inservice training

	All uni. and CAE teachers should be compelled to undertake a course in teaching	All uni. and CAE teachers should voluntarily undertake a course in teaching
% who agree	19	50
% who neither agree nor disagree	16	24
% who disagree	65	26

The university respondents' data support the assertions of the authors cited above that university academics do not approve of compulsion in this area. It was somewhat surprising therefore to find that the Higher Education Research and Development Society of Australasia (HERDSA), through the letter of its President to the AVCC (Lublin, 1981, p 3), has given tacit support to the recommendation that attendance at induction courses be a condition of appointment. 'Programs for new staff are an obvious starting point and this Society hopes that this Recommendation will be tangibly supported.'

The views of both the HERDSA President and the AVCC Working Party are puzzling since the latter presents no evidence that its policy would be effective. The HERDSA position is more baffling since the experience of its members in staff development units should have led to doubt about the effectiveness of compulsion and fear of its consequences.

The Federation of Australian University Staff Associations (FAUSA) has taken a strong stand against that recommendation and, in doing so, appears to be closer to the views of academics in general and probably most staff members of teaching units than is HERDSA.

The assertions by Australian and British writers that university teachers reject compulsory participation in courses on teaching are shown by our data to be well-founded. In addition, our experience leads us to support that view because we do not wish to put at risk the effectiveness or survival of staff development units.

There is clearly another important issue - whether compulsion does in fact infringe the academic freedom of individuals, or any other kind of freedom or right they might consider they have vis a vis their employers. This is a complex issue and is not explored in this paper. Our opposition to compulsion is firmly based on reasons other than academic freedom.

ROLE OF UNITS IN EVALUATION OF TEACHING

Staff development units have always had to deal with the suspicion by some academics that units are merely 'the arm of the administration'. Stanton (1974, p 264) has expressed very well the difficulty faced by units:

> "... a unit must work through persuasion, offering its services to those who voluntarily make use of them. Thus the unit operates primarily in an advisory manner, helping those staff members who seek assistance with their teaching problems. This advisory function would seem to be viable only in an atmosphere of confidence and trust so that the individual staff member could feel secure that his particular teaching difficulty was a matter between himself and the unit. However, should the unit also be made responsible for the evaluation of teaching performance, this atmosphere would cease to exist and the credibility of the unit's advisory function would be irreparably damaged."

In performing our staff development role at the CSHE, we will not give references on teaching ability, to the individual whose teaching we have observed or to anyone else (5). While this is an inconvenience to some academic staff, it is an essential policy. To provide such references could make our role appear ambiguous to others. They may well see us as the 'arm of the administration' and not as helpful colleagues whom they can readily consult without fear of the outcome. The atmosphere of confidence and trust described by Stanton is easily destroyed.

The AVCC Working Party (1981, p xi) recommends that each university's staff development policy should incorporate:

> "a formal evaluation program for all staff involving systematic and regular review of performance in all roles. Such evaluation should be comprehensive both in terms of activities evaluated and sources of evaluative information used. Evaluation should be undertaken for both formative and summative purposes."

The FAUSA Working Party response is quite clear; it strongly opposes the recommendation. In doing so it slightly misinterprets the AVCC Working Party position (6). The FAUSA Working Party (1982, pp 1,2) says:

> "This (the AVCC proposed) programme ... does call for formal evaluation of teaching performance ..... It also calls for an enhancement of the role of staff development units as agents for the development and application of these evaluative processes.
>
> The (FAUSA) Working Party believes that the AVCC is anxious to see this programme implemented in the Australian universities, and that this policy enjoys a groundswell of support among those employed in staff development units.
>
> The (FAUSA) Working Party therefore concludes .....that the role of such units should not be enhanced so that they exercise mandatory responsibilities for the evaluation of staff performance."

Some of the views of the FAUSA Working Party as expressed above are not inconsistent with those of Australian university academics. Over half the respondents to our SERVA/C survey disagreed with the statement that 'promotion for teaching should require assessment by teaching units'. Only about a quarter of the respondents agreed with this statement. Thus our CSHE policy, the views of Stanton, the FAUSA Working Party policy and the attitudes of academics across the country are in agreement - that staff development units should not be involved in evaluating staff performance for promotion.

However, it should be reported that academics in Australian universities do wish to have their teaching effectiveness taken into account for promotion. Ninety three per cent believe it should be although only about one-third of the respondents to our SERVAAC survey believe that teaching ability is currently sufficiently considered. In a real sense, there is a consensus on these issues. Academics want teaching effectiveness taken into account for promotion; but they do not want staff development units carrying out such evaluations; neither do unit staff nor FAUSA.

The AVCC has not suggested that unit staff should be involved in promotion decisions. However, their Working Party seems to suggest the creation of two compulsory evaluative services - one for the administration of institutions (summative - not involving staff development units) and one for the benefit of individuals (formative - probably involving units). This hardly seems practical and cost efficient. In addition, it still forces individuals into a relationship with units, and the issue of compulsion has been examined in the earlier part of this paper. Staff may in any case be highly suspicious or uneasy about a unit being in possession of personal data such as this on all academics.

PARTICIPATION RATES IN STAFF DEVELOPMENT COURSES

Much of the discussion about policies on staff development is based on the assumption that only small numbers of academics are interested in participating in courses on teaching and learning, or at least that only a small proportion ultimately do so. Thus Foster and Roe (1979, pp 17-18) write :

> "No figures are available on how many of the 25,000 or so academic staff in Australian universities and colleges of advanced education have directly participated in staff development activities. However, the proportion is undoubtedly small. Participation is voluntary, and the majority of staff do not see themselves as in need of development.....no institution has staff development as a major preoccupation."

In fact, 45 per cent of the university respondents to our SERVAAC survey indicated that they had at some time participated in an inservice teaching course. In the light of statements by writers such as those quoted above, this figure may seem to be extraordinarily high. Yet our experience at the University of Melbourne (which did not form part of our survey sample) shows that the proportion of nearly a half claiming to have participated in staff development programmes is a credible one. In the four years from 1978 to 1981, a total of 585 staff participated in programmes that we organised on topics related to teaching and learning. Of these, nearly two-thirds engaged in more than just a single seminar or workshop. The total represents about 56 per cent of the academic staff numbers in 1981. This proportion is slightly inflated since staff changes over the four years would have increased the number of potential participants beyond the 1981 establishment but the actual proportion of participants is likely to be near one-half and is consistent with the survey findings. Further substantiation may be found in the results of a survey of management education staff carried out in 1981 (Harman et al). They report that 41 per cent of their university respondents replied positively to the question 'Have you ever made use of a teaching advisory organisation within your institution such as an Education Unit?'

The participation rate among CAE staff appears to be even greater, with 70 per cent of CAE respondents to our SERVAAC survey indicating they had at some time participated in an inservice teaching course.

Our SERVAAC findings and our own experience at the University of Melbourne cause us to be much more optimistic than other writers on staff development. Certainly over the years we have not taken any single approach in our contact with staff. We have tried to offer programmes on matters of particular interest at the time. More recently, we have increased the number of sessions or courses focussing on the learning rather than the teaching side of the teaching/learning interface and dealing with topics other than undergraduate teaching. Also there has been an increasing frequency of cooperatively organised seminars or seminar series taking place within a particular department or faculty rather than being run in the CSHE for staff drawn from across departments. This flexibility and variety of approach has succeeded in attracting substantial numbers of our colleagues. It is doubtful, especially given the survey

results, that our experience is atypical and there is good reason for more optimism than currently appears in the writing of others. Defensive decisions such as introduction of an element of compulsion, made in a pessimistic climate perhaps created by the absence of data, may be the wrong ones; and they may have unfortunate consequences.

WHO PARTICIPATES IN INSERVICE TEACHING PROGRAMMES?

Which academics indicate they have participated in an inservice teaching course? Are they different from their colleagues who have not done so? Comparison of the responses of participants and non-participants to other questions in our SERVAAC survey show some statistically significant variations. For instance, as previously reported (Bowden and Anwyl, 1980), they have different attitudes towards provision of study skills assistance to students. It is not possible here to consider the whole range of variables where differences exist. It is worthwhile, however, to focus on three variables to see whether participants in staff development activities come from different areas, are of more junior rank and use different teaching methods in comparison with non-participants.

Consider first of all discipline area. The survey data show that the areas of Dental Science and Education are over-represented among participants in teaching courses. Seventy three per cent of respondents in each of these areas indicated that they had attended such an inservice course. Engineering and Medicine (59 per cent) were also well-represented with Economics (35 per cent), Humanities (37 per cent), Science and Social Science (both 38 per cent) being under-represented. It is interesting that widest participation tends to be in vocational areas.

Data on our own courses at the University of Melbourne bear out the national data with the Faculties of Dental Science and Engineering having the greatest proportions of staff participating in teaching courses and the Faculties of Science and Arts the least. Perhaps there are lessons to be learned in this. Depending upon their objectives and values, staff in newly established units might do well to look initially for cooperation in the professional areas. Those of us in well-established centres however might ask whether different work needs to be done to match up our programmes with what teachers in the more general courses in the sciences and humanities want and need. Why is their participation generally low? Are they less in need of our assistance? Or are they more doubtful of our expertise? Will they only respond if we devise some different strategies?

A second variable of interest is the rank of participants in teaching courses. The AVCC Working Party (1981, p 7) believes that participation in such workshop and/or seminar programmes is likely to be biased towards new junior staff: 'The programs are frequently aimed at new staff but are rarely exclusive. Some are available to tutorial staff who, indeed, may form the main clientele.' In fact our experience shows this not to be so. Only about 30 per cent of the participants in our programmes in the University of Melbourne have been tutorial staff (compared with their proportion of about 20 per cent in the University population). While participation is greater among the more junior ranks, staff in more senior positions are well-represented.

Table 2 shows the data from our SERVAAC study, Australian Bureau of Statistics data for 1978, and the statistics for participants in our University of Melbourne programmes. (All data are for ranks lecturer and above.) Interpretation of these data should take two things into account. The first is that our SERVAAC sample is biased slightly towards more senior ranks because of our sampling procedures which used university calendars as the source of staff lists. Some staff on such lists had in fact left their institution by the time we sent out our questionnaires and a large proportion of them would have been limited term lecturers. Secondly, the question asked respondents if they had <u>ever</u> participated in an inservice teaching course. Thus senior staff who answered yes to that question may have attended such a programme when they were at a more junior rank. The University of Melbourne statistics reflect the ranks of participants <u>at the time</u> they attended the course. Given those qualifications, it is clear that both the national data and the CSHE statistics indicate a fairly general spread of participation across the ranks. It is not true that junior staff form the main clientele.

TABLE 2

University Inservice Course Participants by Rank

Rank	% Participants (1978 SERVAAC survey)	All university staff 1978 (%) (ABS data)	Uni. of Melbourne participants (%) (1977-1981)
Professor	15	13	10
Reader/Associate Professor	15	14	12
Senior Lecturer	42	38	34
Lecturer	28	35	44

The final set of variables we will consider in our comparison of participants and non-participants relates to methods of teaching. In a previous paper (Bowden and Anwyl, 1981) we showed that academics with certain positive attitudes towards students

> "would be more likely to want to organise their teaching to suit the students rather than to expect them to make their own adjustments. Thus one could expect them to prefer to lecture less regularly, to vary the format when they do lecture, and to use a range of small group teaching methods such as simulation, role play, buzz groups and so on."

It might be expected that academics who have participated in inservice teaching programmes would be more likely to be flexible in and to add variety to their teaching methods. This is so. For example, the proportion of participants who use a range of small group methods is nearly twice that of non-participants. Of course, it cannot be said that participation in such programmes produced this effect. It may be that the courses attract staff who are already quite flexible in their teaching. It is likely however that both explanations are true in part.

WOULD THE CLIENTELE RECOMMEND INSERVICE COURSES TO OTHERS?

It would be hoped that the experience gained by participation in an inservice teaching course is a rewarding one and would cause participating staff to be more favourably inclined towards staff development units than would those who had never participated. Our SERVAAC survey data show that a greater proportion of staff who have participated in an inservice teaching course agree that all universities and colleges should have teaching units to help staff with teaching problems than of staff who have never participated in such a course. Similarly a greater proportion of participants than non-participants agree that all university and CAE teachers should undertake a course in teaching. Thus, at least for some, the experience is a rewarding one.

On the other hand, it is important to know the attitudes of non-participants on these issues. Are they as negative as the AVCC Working Party (1981, p vi) believes when it says:

> "It is commonplace to hear positive reactions from such staff as seek their support; but these staff may well be among the better teachers to begin with. Those who are less effective teachers seldom seek help. It would be rare for an academic staff member to recommend to a colleague that he might improve his skills by seeking help from outside his department; indeed it would be unusual for this subject to be broached at all."

It may well be that the better teachers will be more likely than less effective teachers to seek help from outside their departments but our experience causes us to deny the suggestion that academics would rarely recommend to their colleagues that they approach staff development units for assistance. In the CSHE it is often the case that, after one member of a particular department (say, a department with which we have had little contact previously) has worked with us, approaches are made subsequently by increasing numbers of staff from that same department, or perhaps we are asked to organise a workshop or seminar within the department. Table 3 shows data from our SERVAAC survey which substantiate that intuitive feeling.

TABLE 3

Influence of Inservice Experience on Attitudes of University Teachers to Staff Development Units

Statement	Participants (P) or Non-participants (N-P)	% agree	% neither agree nor disagree	% disagree
All unis and colleges should have teaching units to help staff with teaching problems	P	75	10	15
	N-P	58	23	19
All uni and CAE teachers should voluntarily undertake a course in teaching	P	61	21	18
	N-P	42	26	32
All uni and CAE teachers should be compelled to undertake a course in teaching	P	23	19	58
	N-P	15	15	70

Certainly, participants are more likely than non-participants to agree with each statement. However, between one-half and two-thirds of those who have never participated in an inservice teaching course agree that all universities should have a teaching unit. In addition over two-fifths of these non-participants agree that all university teachers should undertake a course in teaching. These data indicate that the AVCC Working Party view quoted above is wrong. It is encouraging that less than one-fifth of respondents disagree with the suggestion that all universities should have a teaching unit and that less than one-third disagree with the fairly extreme statement that all university staff should undertake a course in teaching.

The data for CAE respondents to our SERVAAC survey are similar for the first two statements in Table 3 and, as already noted, show a greater support for compulsion as presented in the third statement than do university respondents.

CONCLUSION

Foster and Roe (1979, p 35) state:

> "Thus staff development is to an unknown extent dependent on acts of faith and the operation of intangibles. The majority of Australian academic staff would not respond to direct approaches. Nevertheless, most units persist in direct staff development programmes, for two main reasons: one, to cater for the keen or willing minority; and two, because they hope for substantial indirect effects from direct programmes; for example, those who attend courses talk to others who do not; a member of staff who has 'developed' may influence others in his department who have not."

The data we have presented in this paper indicate that those directly assisted are not the small minority they are thought to be and that the remaining academics are fairly well-disposed towards teaching units and their courses. Both the direct and indirect effects are likely to be fairly strong. These findings are in marked contrast with much of the literature.

We have argued against the introduction of compulsory induction programmes and compulsory evaluation of teachers by unit staff because the relationship between academic staff and the unit might be put at risk. We also believe that, given the supportive attitudes that academic staff have towards staff development units and their role, and provided that insensitive institutional policies on staff developent are avoided, it is likely that such units will continue to flourish.

NOTES

1 In developing these propositions, reference is made to the Australian Vice-Chancellors' Committee's Working Party Report (1981) on academic staff development and several public statements by two organisations representing academics: the Federation of Australian University Staff Associations and the Higher Education Research and Development Society of Australasia.

2 The SERVAAC data were collected by mailed questionnaires distributed to academic staff of rank lecturer and above in ten universities and thirty CAEs. Some 2 150 completed questionnaires were received representing a 56 per cent response rate. The sample was stratified according to the size of institution based on numbers of full-time teaching staff of rank lecturer and above. Some institutions in two states were over-sampled to enable a specific case study and interstate comparisons to be carried out. After allowance for over-sampling, a nationally representative data file has been established consisting of about 600 variables for 1 735 cases. Analyses reported here have been computed using the 816 university and 919 CAE cases in this file.

3 SERVAAC respondents were asked:

A Indicate the extent of your agreement or disagreement with each of the following statements (a five-point scale was provided for each question, with the labels strongly agree, agree, neither agree nor disagree, disagree and strongly disagree):

a All university and CAE teachers should be compelled to undertake a course in teaching
b All university and CAE teachers should voluntarily undertake a course in teaching
c Promotion for teaching should require assessment by teaching units
d All universities and colleges should have teaching units to help staff with teaching problems

B Have you ever participated in an inservice training course?

4 The questions asked of respondents to our SERVAAC survey dealt only with the teaching/learning aspects of the role of staff development units. This paper therefore considers only this narrower view of staff development.

5 On request, we are willing however to write to the promotions committee or prospective employer to explain that this is our general policy and why. The only exception to our general policy involves staff who have enrolled in the Diploma in Education course, Tertiary Method, which we offer through the Faculty of Education. They have the normal rights of any student to ask for comments on their attainment during the course.

6 There is a question about the accuracy of the implications by FAUSA that the AVCC Working Party intends units to become involved in this way, and that the unit staff welcome that. In fact they are innacurate, as evidenced by the following passages from the AVCC Working Party document (1981, pp 19, 29-30):

"A central service, such as a staff development unit, is an obvious formative evaluation agency. Not only are the staffs of such units qualified in this area but they are also likely to be more neutral evaluators than are students, colleagues, department heads, or the lecturer himself. However, summative evaluation by a central agency is likely to be viewed by a lecturer as very threatening, thereby compromising the value of the unit as an advisory service.....

The Working Party discussed on several occasions the vexed question of the involvement of units in tenure and promotion decisions. Such decisions are made by academic committees, that is, essentially by peer evaluation. It would be

inappropriate for unit staff to be members of tenure or promotion committees and indeed inconsistent with the view of staff development and of the role of units taken in this Report."

Lublin (1982) puts the HERDSA point of view in a letter published in The Australian Higher Education Supplement when she says: "It is a principle of staff development units throughout the country that they act with and for the academic, and that they do not act as data gatherers about academics for administrative purposes."

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Residential Workshops as Strategy for Staff Development at Universiti Sains Malaysia

Shawaluddin Anis and Chuah Chong Cheng
Universiti Sains Malaysia

ABSTRACT

This paper describes Universiti Sains Malaysia's experience in using residential workshops as a strategy for staff development. Although this paper will focus on the residential workshops, it will first identify the university's staff development needs in relation to the upgrading of teaching and learning processes within the university. As such it will provide a background summary of some of the teaching and learning activities organised at this university leading to the establishment of the Teaching-Learning Advisory Unit.

Several issues pertaining to the running of the residential workshops particularly regarding the perceptions of some concepts related to the residential workshop and the teaching roles of the academic staff members will be discussed. In addition to the above findings, other significant results of the evaluation of these workshops will also be focussed on. The implications of these results, together with the experiences learnt through running these workshops will be used as a basis for developing a strategy for the organization of further workshops.

Shawaluddin Anis, M.S.J. (Northwestern University, USA) CNNA Postgraduate Dip. Ed. Tech. (Dundee College of Education U.K.) is in the Teaching-Learning Advisory Unit, Universiti Sains Malaysia. Has taught in the Department of Mass Communication for the past six years and currently attached to the Teaching-Learning Advisory Unit, USM. Current interest in issues of staff development, interpersonal communication and mass communication.

Chuah Chong Cheng, Ph.D., CNNA Postgraduate Dip. Ed. Tech. is the Co-ordinator of the Teaching-Learning Advisory Unit, Universiti Sains Malaysia. Has taught in the School of Biological Sciences for the past ten years and currently interested in issues of professional development of academic staff, programmed text, and computer assisted instruction.

Address for Correspondence: Dr. C.C. Cheng, Teaching Learning-Advisory Unit, Universiti Sains Malaysia, Minden, Penang, Malaysia.

The realization of the need for staff development at Universiti Sains Malaysia can be traced as far back as in 1973. The first indication of such awareness was a presentation of a paper entitled 'Teaching Methods' by the First Vice Chancellor, in one of the University Senate meetings in the same year (Sharom Ahmat and Boey Chee Khiew), 1979).

In 1975, together with the Regional Institute for Higher Education and Development in Singapore, a conference on the Teaching-Learning Process in Higher Education was held at this university. This international conference marked the beginnings of the new era in the history of staff development at this university. The concept of staff development was strongly supported by the Vice Chancellor himself and the conference was followed by series of short workshops and discussions organized and conducted by foreign experts on the campus.

Further development took place in 1977. In the same year a Senate Working Committee with the responsibility of carrying out teaching and learning activities was finally formalised. As a result further workshops, discussions and seminars were organized with the assistance of several foreign experts from overseas.

With the rapid progress in staff development activities, the university administrators felt it was timely for such activities to be evaluated and rationalised. The need for rationalisation of these activities was necessary because it was felt that since these activities form the basis for dissemination of innovations regarding the teaching and learning process to the staff, it should not be left to be organised on an *ad hoc* basis. There should be an established platform on which these activities can be organised and they should be conducted on a more regular basis.

Another important factor which was being considered at the time was the establishment of a core of personnel to help conduct these workshops. So far the university has depended heavily on visiting experts. It was felt that while constributions and services of these visiting experts have been useful in the past, this at best, can only be a temporary arrangement especially in the view of the increase of number of activities being planned. Besides there were found to be some difficulties and shortcomings in relying exclusively on visiting experts. These shortcomings were for examples, the availability of the visiting experts when needed, the problems of scheduling of such activities, and the increasing expense of bringing people from other countries. But the most important shortcoming is the provision for continuous supervision at the implementation stage of such activities. In many cases supervision was often neglected and thus this tended to reduce staff enthusiasm. In addition, there were times when visiting experts may have some difficulties in identifying the local problems and needs as they were in the country for short periods of time thus often unable to provide appropriate suggestions tailored to the needs of the local staff. These were some of the problems usually associated with the use of foreign experts over very short periods of time and can only be reduced by involving to a large extent local experts.

As the results of these evaluation and rationalization processes on the part of policy makers, in 1980 two staff members were send abroad for further training and on their return to run the unit with the aim of organising staff development activities into more regular and permanent activities. This unit, the Teaching-Learning Advisory Unit was established with the major terms of reference as follows:-

1. To assist academic staff understand more fully the teaching-learning process and thus enable them to improve the effectiveness of their teaching.

2. To assist students in acquiring proper and effective study techniques.

3. To encourage, assist and conduct research into teaching-learning effectiveness.

The unit, over the years had organised many activities related to the above terms of reference. For this discussion we will focus on the use of residential workshops as a strategy for staff development. Residential workshop in the context of this university is defined as being a retreat workshop where participants are housed in one building, food and lodging were provided for a period of four days.

The aims of the residential workshops

The aims of the residential workshops could be broadly classified into four major categories as follows:-

1. To sensitize inexperienced academic staff to the difficult problems associated with the process of teaching and learning in the university.

2. To expose academic staff members to the wide range of teaching-learning approaches, methods and techniques which can be used within the university setting.

3. To overcome academic staff inadequacies and shortcomings in their own teaching.

4. To establish close relationships among acadmeic staff of the university to that they could learned from each other within their own subject expertise.

Residential workshops as strategy for staff development

Given the above aims of the residential workshops as outlined above, it was felt that this type of staff development activity is more appropriate in meeting the overall aim of the university which is to encourage academic staff to be more aware of the need to constantly monitor and improve on their teaching effectiveness. In addition, residential workshops were felt to have certain advantages. These advantages are as follows:-

1. Within the residential workshops where participants are gathered together for a period of time, there is ample opportunity for them to express their needs to the organisers. This expressed needs can be immediately dealt within the workshops.

2. Residential workshops were able to gather participants for a period of time without interruption or being called away for other mundane on-campus distractions.

3. Residential workshops provide the opportunity for group work and understanding each other problems and difficulties. This sharing of thoughts and difficulties can also creates better relationships among participants. In a small institution like ours getting to know one another and sharing similar experiences will encourage further learning and this is highly desirable.

4. In an extended group sitution such as the residential workshops where there is a constant interaction among participants, it may provide the opportunity for participants to change their perceptions and attitudes.

5. Cohesiveness of groups formed through residential workshops may be extended such that these groups can be maintained in carrying out further staff development activities. Establishing this relationship is an asset to promote staff development activities.

Special considerations in organizing the residential workshops

Based on our experience in conducting such workshops there are five important considerations which we feel worth mentioning in this paper. To a large extent, the success of the workshops would seem to depend on how well the organizers deal with the following factors: (i) the venue of the residential workshops (ii) the scheduling of the residential workshops (iii) the duration of the residential workshops (iv) the participants of the workshops and (v) the personnel running the workshops.

(i) Venue

Experience at this university and elsewhere have shown us that the venue for the residential workshops can contribute to the success of the workshops. Often the venue determine participant's attendance and motivation to work. For example, we were given two alternative locations to choose from. One the residential workshops to be held on campus and the other outside campus. Past experience with other workshops of similar nature have shown that if residential workshops were to be held on campus, for some reasons or other the attendance tend to to be low and the 'drop-out' rate high. There were sufficent indications to show that participants were less motivated to follow through the on campus workshops even though they were provided with free lunches, cofee and tea. This often was reflected in the behaviour of participants, such as coming and leaving the workshop sessions while they were held on campus. In addition, there seemed to be constant distractions like telephone calls, messages which have to be attended to and thus interrupted the flow of the workshop sessions. Ultimately this reduced the workshop effectiveness.

It was also felt that in order to avoid the above problems it was recommended that the workshops to be held elsewhere outside campus. To further discourage participants from leaving during the workshop sessions they were asked not to bring their own transportation to the workshops. As as a compensation for their inconveniences, attempts were made to make their stay as comfortable as possible. A beach hotel at the reasonable cost was used as venue for such a purpose. This seemed to boost participants morale and motivation to attend the residential workshops. In addition, at the end of the workshops, a certificate of attendance was presented to participants as a token of university's appreciation of their efforts by the Vice Chancellor personally. These certificates can be used as testimonials to support staff in the confirmation of tenure and for promotion. The presence of top administrators and the award of the certificate seems to further help boost participants morale and sense of commitment to the workshops.

(ii) Scheduling

With regard to the scheduling of the workshops, experience has shown us that there is never any time that is convenient for everyone involved. Nevertheless it had been suggested that in order to maintain full participation there had to be some sacrifice on the part of the participants with regard to scheduling. Further, by scheduling the workshops during the semester, participants are then provided with the opportunity to immediately try out what they have learnt in the workshops in the teaching of their courses. There is no time gap between theory and practice. This is important, as the longer the delay or gap between theory and practice, the more discouraged staff members will be in implementing ideas and skills at the workshops.

(iii) Duration

As to the duration of the workshops, again experience at this university and elsewhere suggests that the workshops of this nature should not exceed more than four to five days at a stretch. This is because most often participants' concentration span tend to decline drastically after this period. At least this is true in most of our cases. Perhaps this is due to our hot and humid weather and the intensive workshop activities. Four to five days workshops seem to achieve more success than longer periods. In order to overcome the problem of decline in participants' concentration as outlined above, the residential workshops were organised to take place over two weekends.

In our view the scheduling of the residentail workshops over two weekends of two days each is the optimum period of time on one hand to transmit sufficent amount of information to make the workshops worthwhile and on the other, maintain a high level of concentration amongst the participants.

(iv) Participants

In our case the residential workshops are specifically used as an induction programme for new academic staff focusing on the processes of teaching and learning. Thus, the selection criteria used for these workshops are (a) academic staff who have little teaching experience (b) academic staff who do not have any formal training in the field of education and (c) academic staff who have not attended similar courses before.

There are several reasons for selecting participants from new faculty staff. One is that new staff tend to be the younger members of the academic community and as such they are the ones who are likely to accept change and innovation. Secondly, these staff are the ones who are more likely to need support and assistance in their teaching and indirectly this will be beneficial for them, as teaching is one of the criteria used for awarding tenure. Residential workshops in some way be regarded as providing the proverbial carrot to these staff.

Our experience also suggested that ideally, the participants for the workshops should be homogeneous in nature in many aspects, so that the workshop topics could be dealt with in greater depth. However in these workshops participants tend to be heterogeneous due to several reasons. In our university, participants for the workshops are nominated by the Deans of the various schools who seem to have different sets of criteria for nominating their participants. There were some cases where some school Deans nominated participants who do not fullfill the criteria mentioned earlier (such as new faculty staff). On the other hand, there were Deans who send the participants to the workshops those who had volunteered. As a result, the usual group of participants for these workshops were heterogeneous in age, experience and expectations. These tend to create problems for the organisers of the workshops. At the beginning of the workshops it was observed that there were some signs of resistance among these participants who were nominated rather than those who volunteered but these feelings were greatly reduced as they found the workshops were useful to them. The problem of differing expectations is more difficult to overcome. This is because the aims of the residential workshops in many ways conflict with their expectations.

Therefore, it was felt that the selection of participants for the residential workshops should be aimed at fulfilling the objectives and expectations of participants.

(v) Core personnel of the workshops

It was felt that in order for the residential workshops to be organised successfully an activity conducted solely by local experts, the residential workshops need the support and co-operation of experts from other related areas like the School of Educational Studies, the Educational Technology Unit, the Language Unit, the Performing Arts Department, the Off-Campus Unit and the Teaching-Learning Advisory Unit. The services and expertise of these units were utilised and together they formed the core of personnel in conducting the residential workshops. The utilization of local expertise in the related areas of staff development have found to be fruitful and rewarding experience.

Evaluation of the Workshops

The workshops were evaluated on two accounts. The general evaluation and the specific evaluation. In the general evaluation, a semantic differential questionnaire was employed to measure participants' perceptions on the number of relevant concepts before and after the workshops. This can also be used to measure attitudes indirectly. The concepts measured were as follows:- 'residential workshops', 'university lecturers', 'university teaching', 'university students', and 'Universiti Sains Malaysia'.

The primary objective of this evaluation was to determine the changes if any, in the perception and indrectly the attitudes amongst participants before and after attending the residential workshops. The specific evaluation on the other hand attempts to evaluate each session within the residential workshops themselves.

Outcome of the residential workshops

For the purpose of this discussion, only the more significant results will be mentioned in this paper. These results were divided into two group as follows:- (i) results of the participants perceptions of the workshops and (ii) results pertaining to specific workshop sessions within the residential workshops.

(i) Perceptions of the residential workshops

(a) Overall, there is a larger standard deviation in the scales for all the concepts measured before than after the workshops. This suggests that participants come to the workshop with varying perceptions of these concepts. However after the sessions and perhaps after interacting with other participants, these perceptions are more similar in nature. There seem to be closer consensus in their perceptions of these concepts. This is only to be expected. Prior to the workshops perceptions of these concepts may be uninformed and perhaps based on hearsay rather than facts. (Refer to Appendix V)

(b) One of the dimensions of the semantic differential is potency which deals with the relationship of strength and force of the concept. This may be related to the perception of the workload of the staff with regard to the workshops. In the concept, 'Residential Workshops', measured, the results show that prior to the workshop, the potency scale were scored lower than after the workshop. This suggest that prior to the workshop, participants perceived the workload of the workshops as very light and easy perhaps because of the location of the workshops (i.e. beach hotel). However after the workshops they realized that the workload was heavier than expected.

(c) Another interesting finding which is worth mentioning here is that after the residential workshops had ended participants reactions to the concept of 'university lecturers', in general were not as positive as compared to the earlier responses. Information gathered informally revealed that this might be due to participants realizing the importance of university lecturers to acquire certain basic knowledge and skills in teaching. Study on staff profile of this university revealed that only about 20% of the total number of academic staff and any formal training in the related field of education (Shawaluddin Anis 1980). Academic staff who have undergone formal in-service training in the field of teaching and learning were also limited, only about 20.6% (Refer to Appendix II & III) Perhaps, this set of statistics can be used to explain participants' reactions.

(d) Looking at the participants' reaction to the concept of 'university teaching' there seem to be differences of perceptions before and after the workshops. The perceptions of participants of this concept prior to the workshop tended to be positive. But results obtained after the workshop contradicted this perception. After the workshops, participants seemed to perceive that university teaching less positively than it was presumed earlier. It was also observed that participants' responses were more conservative. This is clearly shown when participants rated the concept of 'university lecturers' as 'severe'. This implies that prior to the workshop, participants felt satisfied with their performance as teachers. However, after being exposed to the various methods of teaching in the residential workshops, they realised that their knowledge and skills in this university is perhaps inadequate.

(e) With regard to the concept of the 'students', the results were quite surprising. What was revealed here was that generally, participants have a negative perception of students. Further investigation indicates that

participants knew very little about the students. Perhaps this was because most classes were very big and the interpersonal relationships between lecturers and students were limited. However, we felt that this phenomenon is common in many universities here and elsewhere, where the student-staff ratios were large.

(f) When asked how they felt about the concept 'Universiti Sains Malaysia' the responses were varied. Some were extremely positive while others extremely negative. But majority of the participants responded to the concept rather conservatively. Perhaps, this is because the time given to evaluate the concept was too short (i.e. the difference of one month). However, it was believed that these perceptions were based on the past experiences and associations of participants had with the university.

In short, we felt that responses of participants perceptions in this evaluation to certain extent, was influenced by the workshops, specifically the changes in perceptions detected after the workshops. However, it needs to noted that although a pre-and post-design was used in this evaluation, there is a gap of one month between the two parts of the workshops. This variations of these responses cannot be solely attributed to the workshop.

(ii) Evaluation of specific workshop sessions within the residential workshops

With respect to the second type of evaluation, a set of questionnaires was administerd immediately after each session of the workshop. Participants were asked to rate each session on the following variables; satisfactory, relevant, feasible, acceptable, interest, time scheduling, confidence, effectiveness and perspective. In addition participants were also asked to respond to the open-ended questions at the end of the questionnaire. The workshop sessions that were evaluated were as follows:- 'Lecturing Techniques', 'Bahasa Malaysia', (Medium of Instruction) 'The Use of Audio Visual Aids', 'Assessment and Evaluation', Tutorial Techniques', 'Writing Course Objectives', 'Learning Techniques', and 'Distance Teaching'.

From the summary table (refer to appendix IV) for the specific evaluation there are several interesting results which we would like to share with you in this discussion. They are the following:-

(a) It would seem that the session on the Use of Audio Visual Aids, Assessment and Evaluation, Tutorial Techniques and Lecturing Techniques are those which score more than 80% in each of the categories of the evaluation. These sessions are those which are involved directly with the teaching role of the university lecturers and are preceived as being most relevant and helpful. One point to note that for the session on Lecturing Techniques less than 80% participants indicated that they were dissatisfied with their present mode of lecturing. This is encouraging sign in that at least most participants were aware and honest enough to admit their weaknesses.

(b) The session on distance teaching was rated as being useful, relevant, etc. less than 50% in all except the category where the participants had to indicate whether the session had help to increase their perspectives or not. This result can be explained in that the session was used to explain the genral policies for the Distace Teaching programme at the university, where as the participants were of the expectation that they will be shown the nitty gritty work of preparing materials for distance teaching. Thus they feel that while they have increased their awareness of the Distance Teaching programme, they were not given the opportunity to practise producing materials for the programme.

(c) It is interesting to note that although the participants rated the session Writing Course Objectives high (80%) in categories such as acceptability, feasibility, interest, increased perspectives, increased in effectiveness and confidence, they rated relevant and satisfaction lower than 80%. There seemed to be some confusion here regarding the relevance and importance of using objectives for their teaching.

The confusion lies with the perception of the lecturer of the objectives as being an important aspect for the transmission of knowledge. While they found that it is relatively easy to write course objectives of different types, in practice it was difficult to achieve objectives which do not involve recall of knowledge.

(d) The opinions of participants regarding the time allocated for each session were very informative. For nearly all sessions the opinions are roughly divided between those who feel that the time allocation was sufficient and those who do not. This is significant as further investigation showed that those differing opinions were based on expectations held for the purpose of the workshop. Those who felt that there were sufficient time were those who saw the workshop as a general briefing session where they will be given some information regarding the process of teaching and learning at the university. On the other hand those who felt that the time is insufficient were those who expected the workshop to be an opportunity to try out skills and to solve their own specific problems.

Conclusion

We would like to conclude this discussion by highlighting some conclusions which we have reached through our experiences of running the residential workshops for our staff and also through some inferences which can be made from the evaluation. These conclusions are as follows:-

(a) One of the important decisions which have to be made in organising a residential workshop is the selection of appropriate venue. As indicated earlier the failure of participants to attend the workshops and the need to motivate them without outside distractions were the major problems. In our minds the venue of the workshops in many ways can determine the success or failure of the residential workshops.

(b) The scheduling the workshop is also important. Experience in running these workshops at our university have shown us that there is the difficulty in choosing a time which is convenient for all participants. However as staff development is seem as being an important aspect of the university activity, most staff are willing to sacrifice some of the time for it. At this university, we found that holidays were never a good time because of the staff tend to be away on leave or committed to writing or to research. Besides it is more desirable to schedule these workshops during term time as to encourage participants to try out newly acquired knowledge and skills immediately.

(c) The climatic conditions notably the hot and humid weather seem to have an effect on participants' concentration span and thus have an effect on the duration of the workshops. Our experience tells us that four to five days of a workshops were more favoured and will achieve more success than longer periods.

(d) One of the problems which we have encountered in organizing these workshops is the difficulties in the expectations and needs of the participants. The evaluation had shown us that participants come with different expectations. Since the intention of the residential workshop is to provide an introduction to the different aspects of teaching and learning, it is essential that these participants should be selected from those who feel that such workshops would be useful. Perhaps, for those who have the expectations and needs for in-depth in these aspects, further workshops on specific topics can be organised.

(e) There is a need for us to begin to utilise locally available expertise for the residential workshops. This is desirable as the local experts will be more in tune with the indigenous problems and conditions. One way is to build a source of core personnel who can be utilised for the running of the residential workshops.

(f) Workshops situations seem to give the opportunity for participants to work together and for them to understand one another's problems and difficulties. The sharing of thoughts seem to create better relationships amongst staff and thus encourage learning through peers. But most importantly, based on the results through the use of the semantic differential it would seem that perceptions and attitudes of participants can be influenced through the participants' interaction during the residential workshop sessions. In addition, there seem to be enough indications that participants of the workshops were likely to participate in follow-up activities after attended the residential workshops.

ACKNOWLEDGEMENTS

The authors wish to thank all the lecturers who have participated in the residential workshops and the core personnel from the Educational Technology Unit, the School of Educational Studies, the School of Humanities, the Language Unit and the Off-Campus Unit who have assisted in the different sessions of the residential workshops. Special thanks to Mr Zainal Dato' Ghani and Dr Peter Choo for helping us with the evaluation of the workshops. Lastly but not least, we wish to record our appreciation to Professor Sharom Ahmat, the Deputy Vice-Chancellor (Research and Development) for his constant encouragement and support that has enabled us to conduct the residential workshops successfully.

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Appendix I

Residential Workshop Timetable
for 1981

Date	8.30-9.30 am	9.15-10.15		10.30-12.30	12.30-2.00 pm	2.05 - 3.00		3.10 - 5.00	6.30 8.00	8.00 - 9.30
Sat. Sept. 5th		Registration		Lecture Techniques TLAU		Bahasa Malaysia LU		Bahasa Malaysia LU		Preparation for Micro-Teaching
Sunday Sept. 6th	BREAKFAST	Audio Visual Aids ETU	TEA	Audio Visual Aids ETU	LUNCH	Micro-Teaching Group 1 Micro-Teaching Group 2 TLAU	TEA	Feedback Group 1 Feedback Group 2 TLAU	DINNER	
Sat. Oct. 10th		Assessments and Evaluation		Assessments and Evaluation		Tutorial Techniques		Tutorial Techniques		
Sunday Oct. 11th		Writing Course Objectives TLAU		Distance Teaching OCU		Learning Techniques TLAU		Workshop Evaluation TLAU		

References:-

ETU: Educational Technology Unit
LU: The Language Unit
TLAU: teaching Learning Advisory Unit
SES: School of Educational Studies
OCU: Off-Campus Unit

Appendix II

Staff Activities in 1980/81 and 1981/82

	1980/81	1981/82
Informal Discussions	57	147
Residential Workshops	38	-
Information by post	30	35
Microteaching	5	1
Resource Centre Learning Adis Lab.	-	8
Computer Assisted Learning	-	20
Programmed Text Studios	-	20
	134	243

Appendix III

Year	Date	Venue	No. of Schools	No. of Units	No of Academic Staff Participants
1978	25-30 July	Country Club Langkawi	8	0	22
1979	18-21 Aug	Palm Beach Hotel, Penang	10	1	26
1980	-	-	-	-	-
1981	5-6 Sept 10-11 Oct	Holiday Inn Penang	11	3	38
Total No Of Academic Staff in U.S.M. (1981) 417				Total	86 (20.6%)

Appendix IV

Specific Evaluation of the Workshop

	Satisfied	Relevant	Feasible	Acceptable	Interesting	Increased Perceptions	Increased Effectiveness	Increased Confidence
High Responses More than 80%	AVA AE TT - - - -	AVA AE TT Lec T LT - -	AVA AE TT Lec T - WCO -	AVA AE TT Lec T - WCO BM	AVA AE TT Lec T LT WCO -	AVA AE TT Lec T LT WCO - DT	AVA AE TT Lec T - WCO -	AVA AE TT Lec T LT WCO -
Average Responses 60 - 79%	LT WCO BM Lec T	- WCO BM -	LT - - -	LT - BM -	- - - -	- - - -	LT - - -	- - - -
Low Responses 50% and below	DT	DT	DT	DT	DT	-	DT	DT

AVA = Audio Visual Aids
AE = Assessment and Evaluation
TT = Tutorial Techniques
Lec T = Lecturing Techniques
LT = Learning Techniques
WCO = Writing Course Objectives
BM = Bahasa Malaysia (Medium of Instruction)
DT = Distance Teaching

Appendix V

SUMMARY OF THE PARTICIPANTS' PERCEPTIONS AFTER THE WORKSHOPS

Concept	Scale															Comments
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	
Residential Workshops				→					→				←			Participants opinions were more homogeneous after the workshops.
University Lecturers		←											←			Respons were more homogeneous after the workshops to the activity dimension
University Teaching							→									
University Students		←		←	←	→	→			→					→	Responses were more homogeneous after the workshop in the dimension potency and activity
Universiti Sains Malaysia																No different in mean before and after the workshop, but increased in the three dimension of potency activity and evaluation

Note: → High mean referring to the adjective polar with opposite meanings

← Lower mean referring to the adjective polar with opposite meanings.

Debriefing Academics About Their Teaching

Eve M. Barrett and J.P. Powell
University of New South Wales

ABSTRACT

Nine university teachers were interviewed at weekly intervals in order to explore ways in which they monitored and modified the development of one of their courses. This paper reports the effects of these debriefing meetings on the manner in which these teachers reflected upon their courses, teaching methods, and role as a teacher. Initial analysis of the data also suggests that weekly debriefing has implications for both academic professional development and course evaluation.

Eve M. Barrett, B.Sc.(Econ.)(Lond.) is an Education Officer in the Tertiary Education Research Centre at the University of New South Wales. Her main research interest has been the selection and performance of mature age students. Current interests include student progression, adult learning, and postgraduate students.

J.P. Powell, B.A.(Brist.,), M.A. (Dublin), Ph.D. (ANU) is the Director of the Tertiary Education Research Centre at the University of New South Wales. He is the author of over 100 papers in the fields of philosophy of education and higher education research. Current interests include student learning, the academic profession, and staff development.

Address for Correspondence: Ms. E.M. Barrett, T.E.R.C., The University of New South Wales, P.O. Box 1, Kensington 2033 N.S.W.

Introduction

For academics teaching is an essentially private activity. Unlike teachers at the primary and secondary level, who may be subject to scrutiny from both their peers and from educational administrators, academics mostly teach unobserved. As a result, very little is known about the way they plan and monitor these activities. Powell and Shanker (1982) draw attention to the recent growth in research on the topic of teacher thinking at the primary and secondary level but they found no report of studies relating to the tertiary sector. They discuss the differences between the results of this work and earlier more prescriptive writings which attempted to define the strategies which teachers should adopt in the classroom. These more recent studies have shown that what teachers actually do in the classroom is not what curriculum theorists suggest as appropriate behaviour. It is now becoming more widely acknowledged that, in order to effect improvements in the quality of teaching, it is necessary to examine much more closely the ways in which teachers think about and approach their tasks.

The study carried out by Powell and Shanker was concerned with how one university teacher planned and monitored his course and it used a debriefing technique to collect data. This technique, by asking non-directive questions, encourages those interviewed to recall and reconstruct their previous thoughts and experiences (Duke, 1977). Immediately after each class one of the researchers interviewed the teacher, recording the interview on audio-tape. The interviews sought to elicit the thoughts and feelings of the teacher about the course as it progressed and his intentions for subsequent class periods. An initial interview at the beginning of the semester discussed his planning for the course and a final interview reviewed it. The data were subsequently analysed using a category system. The authors acknowledge the difficulties of constructing and using such a category system. They recognise that interviewer comments and prompts during the interview may bias the interviewee's responses, that the categories constructed may be too broad, and that such a category system ignores 'non-dominant' content. They conclude that the results of their study revealed similarities with those reported from work with high school teachers (Peterson, Marx & Clark, 1978; Zahorik, 1975) in that this teacher's major concerns were ".... the covering of course content and the participation of students in class discussion."

This paper is a preliminary report on a study designed to extend the research of Powell and Shanker. It identifies some of the major concerns which underlie the ways in which a small group of teachers think about their courses and outlines possible applications of the debriefing technique to staff development and course evaluation.

Method

During one semester nine academics were interviewed once a week about one of the courses they taught. Five researchers worked on the project and, as far as possible, teachers were interviewed each week by the same person. While ideally these interviews should have occurred immediately following classes this was not always possible because of other commitments. An attempt was made, however, to talk to teachers shortly after classes so that they could readily recall what went on in the classroom. These nine teachers are in no way intended to be a representative sample, rather, they are academics who were prepared to give some of their time to assist with a research project. It was essentially a cooperative relationship and they did not see themselves as 'clients' in a staff development situation (Boud & McDonald, 1981). Of the nine academics two had more than twenty years of teaching experience, two were relatively new to teaching, while the others had taught for four or five years. Between them they covered a range of disciplines, both science and the humanities. The courses taught included lecture courses, discussion classes and laboratory classes. The interviews lasted for about thirty minutes a week so that on a regular basis they represented a considerable time commitment for busy academics in semester time. Because of the demands of other commitments one of the nine teachers was obliged to withdraw from the project half way through the semester.

Following a suggestion by Powell and Shanker (1982) a semi-structured interview schedule was adopted. In an attempt to limit interviewer bias the initial question was "How did the course go this week?" followed by interviewee comment free of interruption or prompts. Thus the first part of the interview covered whatever was of

particular importance to the teacher at that time, that is, what first came to mind when they were interviewed. This initial unprompted episode could last from five to thirty minutes. After that the interviewer sought amplification and clarification of the free response episode and then asked the teachers to reflect on what they had been doing during the past week in respect of the particular course, how long they had spent on this, and what they were planning to do before the next class.

The debriefing technique is subject to a number of methodological problems as is any research which involves the process of self-analysis. How accurate is the subject's recall of the events which took place even if the debriefing occurs shortly after? Some researchers in the field of teacher behaviour have used audio or videotapes to stimulate recall (Calderhead, 1981) but as Freyberg (1980) points out stimulating recall in this way can be an anxiety-provoking experience which may limit what the teacher is prepared to recall, that is they may 'selectively forget'. It was not our intention to prompt our interviewees in this way but rather to allow them to tell us about what they felt to be important. While we recognise that there is inevitably some unconscious loss of recall we do not believe that our group of teachers deliberately 'forgot' material because what they talked about was consistent throughout the series of interviews.

Another problem is that teachers may find it difficult to verbalise about aspects of their teaching behaviour, especially that which has developed as a result of experience (Calderhead, 1981). One of our more experienced interviewees gave evidence of such tacit knowledge: prompts from the interviewer revealed that some of his classroom behaviour had become automatic and did not require any real attention on his part.

The weekly meetings, which followed a consistent procedure, resulted in the interviewees becoming familiar with the type of questions we asked with a resultant tendency for them to try to tell us the sort of things they thought we wanted to hear. One even asked "Is this what you are interested in?" intending to be particularly helpful and the interviewer had to emphasise that what was of interest to us were his concerns and whatever was particularly important to him at that time. We were careful not to pass judgement on any of the comments made but rather to encourage the teachers to explore and clarify their own thoughts about their teaching. Calderhead (1981) also suggests that teachers distort their recall so as to present a favourable self-image. This is, we concede, a possible source of inaccuracy but we are reasonably confident that it has not been a substantial problem in our study. We believe that these teachers were at ease in the interview situation and had little to gain from any conscious distortion.

Results

The project has generated many hours of taped interview data some of which has still to be transcribed. The analysis of such material constitutes a major problem in this type of study and was one reason why Powell and Shanker tried to condense their findings into a category system. Although such a category system does allow for greater objectivity in analysis, much of the richness of the data is lost because some details have no place in the categories. The data have yet to be closely analysed but they should be able to yield some useful insights into the way academics plan and monitor their teaching activities and the ways in which these activities are reflected in the decisions they make about the on-going teaching process. What is reported in this paper results from (i) an analysis of the final review interviews, (ii) ideas generated from an initial reading of a number of the other interviews, and (iii) the subjective impressions of the interviewers.

This initial analysis suggests that the teaching concerns of these academics are similar to those reported in studies of high school teachers (Peterson, Marx & Clark, 1978; Zahorik, 1975) and that of Powell and Shanker (1982) in respect of one university teacher. While there are certain concerns which the academics have in common, the degree of importance attached to these varies. In addition the weekly monitoring highlighted the particular concerns of individuals and it is interesting to note that these surfaced early in the semester and continued to be a concern throughout. All those interviewed reported concern about covering the course content in the time allocated and as the semester progressed and examination papers were finalised, covering

what was to appear in the examination papers took on an increasing importance for those who assessed by final examination.

> ... they (the students) are getting more nervous and I think I am feeling a bit more the pressure of time now....I have only got so many classes left. As far as possible I try in the classroom not to show that I am hassled because I think otherwise that becomes contagious - if they are feeling hassled that makes me feel hassled - and then they feel hassled.
>
> Now the thing that worries me is the fact that we have still only got two classes left and I have got to get through enough in those two classes to put them in a position where they can answer one of the compulsory questions...

Discussing such issues on a weekly basis led several interviewees to question their over-riding concern with content and one in particular convinced himself that there was too much content in his course and that it is probably inappropriate for the second year students he teaches. He harboured an element of doubt about this at the beginning of the semester and in succeeding weeks he became increasingly convinced about the need for change.

> I think the things that need changing are -- the content of the course needs reducing and I think that's been demonstrated to me .... by freeing up the structure we really didn't finish and then I had to make some critical decisions about what to skim over ... I think also there possibly needs to be a less theoretical emphasis in the course.
>
> A lot of them - from the feedback that I have got in the past - are not interested in theoretical issues and that really has led me to wonder is this .... the kind of thing I am teaching in second year does not totally take account of their needs as much as it should. I am becoming convinced that the kind of material that I am dealing with really ought to come later in the course.

A second concern relates to students' involvement in the course, either defined as participation in a discussion situation or as attention and continued interest in the lecture situation. Again, the level of concern varies. For one academic in the social sciences promoting group cohesiveness as a basis for subsequent group participation led him to introduce additional group building exercises at the beginning of the semester. Another said that he would need to think carefully about the way future tutorials were structured particularly as two of his tutors reported that they had found the tutorials "heavy going". Other staff reported concern about participation but with less emphasis. A scientist whose main aim was to enthuse his students and who looked continuously for evidence of this enthusiasm in the class, was prepared to omit important theoretical concepts from his delivered lecture rather than risk dampening the students' interest in his subject.

> In fact what I have got to consider seriously and I suppose now as I sit here talking to you and thinking about it - one other option which hadn't previously occurred to me and I will now consider seriously is dropping it entirely. If the subject matter is such that no amount of effort will make it an enthusiastic topic - then I have got to get it out of the course - either get it out of the course or get it into a form where they can go away and read it as background material but to not jeopardise my relations as a communicator of enthusiastic ideas.

A third common concern related to the level of structure in presentation, both in the lecture and tutorial situation. One teacher questioned the advantages of a very formal lecture as against a freer, more spontaneous, presentation. While he felt that the students responded better when he adopted the latter position he was worried that he would be less efficient in delivery and would lack clarity. For several teachers the reported ability to deliver a less formal lecture was seen as influenced by familiarity with the material and years of teaching experience.

> I felt good at the end of the lecture because I had been able to do some-

> thing much more flexibly than I had ever been able to do before. .. The content was probably the same but it's the order of presenting the material .... I thought there's a much more logical structure I can impose on that material. So I did that 'off the cuff' as it were ... it has really taken me four years to be able to do that.

For one teacher the problem of structure, or rather lack of structure, was a prime concern. A student evaluation had indicated that students thought his lectures were difficult to understand because they lacked structure. He had attempted to improve his presentation by sitting in on a colleague's class as this particular teacher was reported by students to give well-organised lectures.

An interesting aspect of the data is that a number of the teachers reported on the difficulty of maintaining a continuously high level of personal involvement in their course over a full semester. After an initial period of settling in, ensuring that the overall planning is in hand, and assessing the level of the students in the class, the first half of the semester progressed without undue strain. In the second half, however, some concern was expressed about the ability to stay enthusiastic as the course threatens to become just one more demand on the teacher's time. This 'low' period was accentuated by events both directly related to the course and unconnected with it. It may be that the increasing anxiety felt by students as the semester nears conclusion affects not only the students but the staff. Time seems to be running out and so much remains to be completed.

> I begin to feel overall - the accumulated feelings about what is happening. I feel in myself that I am a notch lower in the enthusiasm in presentation than I was last year. It's a couple of reasons - one is that I've got an awful lot of distractions at the moment with a number of other things that are a problem....

This concern is compounded by the experience of having taught the same material for several years.

> ...as the material becomes more familiar to me it also becomes less exciting to deliver. You get a feeling like I have said that before and it constantly stops me....

Clark and Yinger (1979) report that teachers in primary and secondary schools usually only consider using alternative strategies in class when things are going badly but that they hardly ever change the instructional process in the on-going class. Our interview data does not provide any evidence that our interviewees planned alternative teaching strategies in advance. Classes seem to proceed much as planned with lectures covering content areas specified in advance. Subsequent reflection about the class may lead to a resolve to make changes at some future indeterminate time. Should students fail to fully comprehend the material covered in the class it is assumed they will make good the gaps in their understanding either by personal consultation with the teacher, by talking to their peers, or by reference to the available written resources. Not diverting too far from the planned content reflects a concern with pitching the teaching at an appropriate level, that is usually somewhere at the level of students at the top end of the middle ability range.

Implications for Staff Development

How did academics react to the process of weekly 'debriefing'? Did they feel at all threatened by the need to be self-critical? In the final summing-up interview we asked them to comment on whether the interviews had been helpful to them in thinking about their teaching. The following comments illustrate their reactions.

> Overall I think it's been quite useful because it really makes the individual - in this case me - focus on what their course is about. ... I think overall there is great value in being forced to sit down and think, well what's happened in your course. I mean where is it going, where did it start from perhaps?

One questioned whether he would have reached the same conclusions without the weekly debriefing interview.

> Yes, I was going to say I've found - in terms of having to reflect over each week's work, I think they have been useful....I would have gone through some of it myself just in reviewing what I've done, but this has helped me to be more structured - just in terms of providing an opportunity to ramble on and reflect over what's gone .... It would be interesting if I'd have come to the same realisation about some of the things I think need changing without this process. I mean that's what's been going through my mind - I wonder would I have come to the same decisions if I had not verbalised some of them.

Additionally, there was the advantage of being able to discuss their teaching in a non-threatening situation.

> It's also interesting to be able to verbalise without having to pay too much attention to the consequences. I mean, one of the comments I made to you about more lectures, well I can say that because I know here there's going to be no repercussions from saying that. The same as a lot of my comments have been critical of myself. Well I think again, you know, in the political arena one has to be careful about how one exposes oneself, that that might be interpreted to one's disadvantage. Here I've found that I haven't been inhibited by saying that I thought the lecture was terrible because it's provided that kind of non-judgemental freedom...

One young lecturer, recently returned from a post-doctoral position overseas and responsible for running a servicing course which required many hours work from a purely organisational standpoint, admitted there had been times when he had considered dropping out of the project. Nevertheless, he also concluded that it had been a useful experience.

> As far as being useful to me, they're useful only from the viewpoint of clearing your thoughts as you verbalise them. I mean that's always useful. The same way as when you teach you also learn. And the same way as when you express something you may get a different perspective on it. But I must say given the very tight time schedule that I've had this session, I was very prone to want to say at a certain time "Well, you know, I don't think it's very worthwhile - I don't want to do it anymore this session because I'm too busy." But I didn't and I'm glad I didn't.

Another, with some reservation, admitted

> As it stands now it has forced me to clarify some things in my mind that otherwise I wouldn't have done and maybe to make some resolves so that I now feel I've made them and I have got to do something about them. So that probably is an advantage in a way. If I feel uneasy about it at all is I really hope I don't let myself down here in failing to make some of these changes I want to make because here I am in this year, having known that I made some of these resolutions to myself the year before and not having done them - so I don't think I could face that again. If I was launching into second session with as little change as this year - that could really affect my performance. A guilt feeling would begin to over-ride me. It's now more than a private resolution made on New Years - I'm on ... tape!

When we began this study we saw it as an interesting and unresearched area but as having little relationship with our staff development activities. However, as the weeks went by we became increasingly aware of the significance of the interviews for the professional development of the participants. Data from our final interview with these teachers supports our subjective impressions in this regard. Despite the time taken up by the weekly debriefing sessions all those interviewed said the time spent had been beneficial. Why was this so? Perhaps the main benefit has been that the individual teachers have been able to clarify their concerns to the extent that they

now feel in a better position to give serious thought to their resolution. At the same time other concerns which seemed particularly important early in the semester faded into insignificance as the weeks passed: talking about these may have led to their being perceived as less problematic than originally anticipated.

The regular weekly meeting also allows teachers to talk about those concerns which, were it not for the meeting, might have got lost among other more pressing concerns. Boud & McDonald (1981, p.10), in their monograph on educational development through consultancy, remark that what surfaces in an initial discussion with a teacher is often only 'the tip of the iceberg or indeed a false lead altogether'. A continuing weekly session such as our debriefing may encourage deeper concerns to surface.

The debriefing interview as used in this project provides a non-threatening environment in which the teacher can explore the classroom processes. As researchers we were not seen as 'the expert' who was expected to resolve identified problems. What we tried to do was to facilitate reflection about teaching in a supportive environment without the fear of being judged. We seem to have been successful in this respect because several of the group were prepared to admit to what they perceived as weaknesses in their teaching.

The data stress the importance of taking into account the context within which each individual academic works which includes how they perceive their relationships with their fellow academics, support staff and others in the wider working environment. One teacher, after several debriefing sessions, talked about the different factions in his Department together with their varying ideologies. He felt a lack of support from a number of his colleagues who did not share his views and this caused him considerable concern. This was reflected through the interviews as he tried to justify (to himself) what he was doing in his teaching. The early interviews demonstrated that he was a dedicated teacher but the reasons for his almost apologetic behaviour did not surface until his relationship with the interviewer was well established.

Implications for Course Evaluation

We were concerned primarily with finding out how teachers planned and monitored their teaching and were careful not to make judgements on any aspects of the courses taught. However, the weekly interviews led to the teachers becoming increasingly involved in self-evaluation. While there are a number of course evaluation techniques available (for example, the use of questionnaires, direct observation, peer evaluation, examination results) the ability to evaluate one's own performance and to recognise when and where change is required is likely to result in the improvement of teaching generally. Without doubt the teachers participating in our project were involved in an informal way in course evaluation. During the semester they talked about such topics as the appropriateness of course content, the level of student interest and involvement in what was being taught, whether or not teaching methods used were best suited to achieving student learning, the relationship of assessment methods to both student workload and learning, and so on. Talking about such issues led them to think about whether their courses needed to be modified in any way. This personal involvement in an on-going evaluation of courses probably occurs to some extent in all teaching but a weekly debriefing session serves to make teachers more aware than they would otherwise be of how the course is progressing.

Conclusions

The data so far analysed provide a vivid picture of the many competing demands made on academics and the problems they face in the conduct of their day to day work. Our data suggest that, as far as our group of academics is concerned, they do know when the teaching process does not go according to plan, they are concerned about this and intend to make changes to resolve these problems. The good intentions may not be realised because of competition from their many other activities, such as personal consultations with students, departmental meetings, administrative tasks and their own research interests. One of our teachers, who was in poor health at the beginning of the semester, battled on with his classes because he felt he could not afford the time to be absent. Later he admitted it would have been better had he taken off some time as continuing poor health affected his teaching performance. Another, succumbing to

a viral infection, was absent for a week. He admitted to spending several weeks trying to 'catch up', a process which drained him emotionally. For staff who teach very specialised courses there is often no-one who can step in and take over - unlike the stage actor the academic 'actor' does not have the luxury of an understudy.

We could find little evidence in our data for detailed course planning at the beginning of the semester. If the course had been taught previously notes written in the past may be scanned with the intention of reviewing and updating when time allows. On a week to week basis our group found it difficult to estimate how much time they spent planning for their next class. It may be that the rather routine nature of most university teaching requires little time for its planning. Preparation, however, can be much more demanding, especially for inexperienced teachers or those who are teaching new courses.

For those staff who conduct educational development activities the project draws attention to the need to really understand why academics make particular decisions and cautions against assuming that these decisions reflect a lack of awareness of alternative strategies on the part of the academic. It emphasises the need for the development of a supportive relationship between the educational developer and the teacher based on mutual trust and understanding. Finding out what are the teacher's real problems may be a time consuming task requiring considerable tact and patience.

As an adjunct to course evaluation techniques debriefing can add considerably to data collected by the more commonly used methods. A non-directive interview following classroom observation can draw attention to teacher concerns that were not apparent to the observer. Debriefing heightens teachers' awareness of classroom processes so that they become increasingly involved in evaluating their own contribution to students' learning.

If a weekly debriefing session is not possible academics could be encouraged to reflect after their teaching by asking themselves the sort of questions posed in the interviews and making brief notes about classroom events and their feelings about those events. One teacher had kept a diary for some time and found it a valuable tool when he taught a course again. He said it was more useful than the marginal asides he had previously scribbled on his lecture notes. After each lecture he spent ten to fifteen minutes reflecting about his presentation and how the class had reacted.

Teaching is a very complex activity and there can be no doubt that any increase in the time devoted to reflecting upon it is likely to enhance both its effectiveness and the personal satisfactions which should arise from it.

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University Teachers' Evaluations of the Impact of Workshops on their Teaching

D.J. Boud, E.A. de Rome and J.P. Powell
University of New South Wales

ABSTRACT

A survey was conducted at the University of New South Wales in 1981 in order to evaluate a programme of workshops for academic staff on various aspects of teaching. A questionnaire was set to 220 members of the academic staff who had attended at least one workshop during the previous two years.

The most frequently noted value of workshops was the opportunity to meet other staff, to realise that others experienced similar problems and to exchange ideas. Other benefits, mentioned included gaining new teaching skills, the opportunity to examine one's approach to teaching and what one was trying to achieve and to gain insights into oneself as a teacher.

Information was also sought on factors which inhibited staff endeavours to improve their teaching. Lack of time was the most frequently mentioned inhibiting factor, followed by lack of incentives or recognition for teaching excellence within the University.

The most important sources of support for the improvement of teaching were seen as being from colleagues and other experienced teachers and from the Tertiary Education Research Centre.

Some implications for staff development programmes are discussed.

David J. Boud, B.Sc., Ph.D.(Surrey), M.Inst.P. is Senior Lecturer in the Tertiary Education Research Centre. He is co-ordinator of the programme for academic staff at U.N.S.W. and is co-author of Educational Development Through Consultancy and a number of papers on teaching and learning in higher education and educational evaluation.

Elizabeth de Rome, B.A. , Dip.Ed.(UNSW) is an Education Officer at the Tertiary Education Research Centre. She is currently involved in research into student course decisions and persistence at University.

J.P. Powell, B.A.(Brist), M.A.(Dublin), Ph.D.(ANU) is the Director of the Tertiary Education Research Centre at the University of N.S.W. He is the author of over 100 papers in the fields of philosophy of education and higher education research. Current interests include student learning, the academic profession, and staff development.

Address for correspondence: Dr. D. Boud T.E.R.C. The University of New South Wales, P.O. Box 1, Kensington 2033 N.S.W.

INTRODUCTION

Programmes designed to promote the professional development of academic staff are intended, among other things, to bring about changes in those who participate. The literature concerned with the evaluation of such programmes is sparse and it is apparent that little is known about their effectiveness in facilitating individual professional growth. (See, for example: Hammons, 1975; Hoyt and Howard, 1978; O'Connell and Meeth, 1978; Rothman and Robinson, 1977; Wergin, 1977).

Rhodes (1980) has urged the need for more evaluative studies to be undertaken and has suggested three models which might be used for this purpose. The first concentrates upon output: number of workshops provided, number of participants, range of consultations provided, and so on. The second is focussed upon outcomes: changes in teaching practices, extent of participant satisfaction and, in general, the impact upon the target population. The third is what he calls the instructional model. This views staff members as a group of adult students with specific personal and professional needs and goals. The focus of the evaluation becomes the design and implementation of a teaching programme directed at meeting these needs.

Rhodes argues that it is currently not possible to conduct satisfactory evaluations because the application of one model leaves some of the questions raised by the others unanswered. But if all are used then some of the results are likely to be inconsistent or even in conflict. Despite these, and other difficulties, it is clearly unsatisfactory to continue to offer professional development programmes without making serious attempts to assess their worth. Workshops in the University of New South Wales programme are always evaluated at their conclusion by the participants and this information is used to redesign each workshop if it is to be offered again. Such evaluations, however, give little indication of possible long-term effects upon the attitudes and professional practices of participants. In 1981 we conducted an evaluation study which was intended to provide data which could be used to assess the impact of the programme in terms of an outcome model as defined by Rhodes.

The professional development programme being evaluated was that offered by the Tertiary Education Research Centre at the University of New South Wales. It consists of one-day and half-day workshops on a variety of aspects of university teaching e.g. problem-solving, lecturing, conducting discussion groups, student note-taking, computer simulations, use of films, setting and marking essays and assignments, course design, supervising research students. Academic staff may choose to attend as many or as few of these workshops as they wish.

PROCEDURE

The data were collected by questionnaire. In order to construct an appropriate instrument experienced workshop leaders were asked to provide lists of outcomes which they hoped would be achieved by the sessions which they conducted. It was stressed that these lists should be realistic in relation to the very limited amount of time allotted to each workshop. This procedure yielded 113 items which were reduced to 66 by eliminating overlap. This list was then classified into groups consisting of items relating to actions, skills, knowledge and attitudes. These groups were then further divided into sub-groups relating to personal, interpersonal and professional development. A final list of 20 items was then compiled with each sub-group being accorded approximate parity of representation. A forced-choice format was used for these together with some additional open-ended questions.

The questionnaire (see Appendix A), together with a covering letter, was sent to 220 members of the teaching staff who had attended at least one workshop related to teaching during the previous two years. It was subsequently found that 27 of these, mainly part-time tutors, had left the University by the time the survey was conducted. This reduced the group to 193 of whom 112 returned completed questionnaires, a response rate of 58%. The true response rate may have been higher than this as some of the 81 non-respondents would have been away on study leave.

RESULTS

Respondents were asked to indicate, in terms of a list of items provided, whether participation in a workshop had influenced them in any way. The results have been rank-ordered and are set out in Table 1.

Table 1: Participants' Views on Outcomes of Workshop Attendance

		Yes	No	N/A
1.	I appreciated the opportunity to meet other staff	94	9	6
2.	I realised others experience similar problems	83	11	15
3.	I gained new ideas from other participants	91	22	5
4.	I have thought more about what I am trying to achieve	75	19	14
5.	I subsequently made some changes to my teaching or course design or assessment procedures	70	21	15
6.	I subsequently tried a new approach in some aspect of my teaching	68	23	16
7.	I have become more aware of alternative ways of doing things	66	22	18
8.	I am more conscious of the need to evaluate what I do	64	25	16
9.	I became more aware of my own strengths and weaknesses	64	24	18
10.	I have become more aware of the variety of resources available to me	61	32	15
11.	I now consider using a greater variety of teaching techniques	56	30	21
12.	I gained support for what I was trying to do	48	12	48
13.	I have become more aware of students' needs & interests	46	35	25
14.	I have extended my interest in teaching	43	32	32
15.	I have kept up with latest ideas & practices	43	35	25
16.	I followed up some of the ideas in the workshop through reading or through contact with others	43	52	11
17.	I now seek more feedback from students	42	32	30
18.	I have developed greater self-confidence in handling certain situations	42	34	29
19.	I improved my ability to deal with a common problem I face	36	35	34
20.	I now provide more feedback to students	34	36	35

The three items which were identified most frequently relate to the value of meeting with colleagues in order to share ideas, concerns and experiences. The next most frequent were items relating to becoming more aware of a variety of approaches to teaching and gaining greater insight into oneself as a teacher. At about the same level of frequency was a group of items relating to changes in areas related to the practice of teaching. Near the bottom of the list came items concerned with follow-up activities such as reading and contact with others.

Respondents were also invited to make written comments on what they saw as the most important benefits which they derived from workshops. Almost everyone made a comment and the results, not surprisingly, reflect the data presented in Table 1. The most freuqently mentioned (32) benefit was sharing ideas and concerns with colleagues.

"Chance to exchange ideas with colleagues from other disciplines."

"Meeting others with similar problems."

The next most frequently mentioned (18) benefit was related to teaching skills.

"Practice in the technique of explaining concepts."

"The ability to conduct more relaxed and friendly classes."

The other major benefit, mentioned by 11 respondents, was gaining insight into oneself as a teacher.

"I became more aware of my own strengths and weaknesses."

"Insight into myself as seen by students."

Respondents were then asked to elaborate on ways in which the workshop programme

might be made more effective for them. The largest group of suggestions (22) concerned the manner in which workshops were conducted. The only other substantial group of comments (12) related to making workshops more discipline-specific and departmentally-based.

The survey provided an opportunity to gain information on aspects of teaching development not directly related to the programme. For example, respondents were asked to indicate their involvement in other professional development activities during the previous three years. Most people had something to say about this but it was often not related in any direct way to teaching. The relevant responses mentioned the following activities:

- Attended conference or seminar related to teaching my subject (12)
- Attended workshops or courses elsewhere (7)
- Enrolled in Dip.Ed. (4)
- Obtained student evaluation of teaching (3)
- Involved in curriculum development activity (3)

Information was also sought on what the group saw as impediments to their own efforts to improve teaching. The responses to the list of items provided have been rank-ordered and set out in Table 2.

Table 2: Participant's Views on Impediments to the Improvement of Teaching

		Yes	No	N/A
1.	Lack of time	79	24	5
2.	Lack of recognitioin/incentives for teaching	49	47	10
3.	Course structure	44	53	10
4.	Inadequacy of rooms/space	44	56	9
5.	Lack of equipment/materials	41	56	11
6.	Attitudes of students	41	58	8
7.	Lack of funds	40	54	14
8.	Timetabling	33	66	10
9.	Attitudes of colleagues	32	65	11
10.	Attitudes of my Head of School/Department	13	78	17

Lack of time emerged as far the most commonly mentioned obstacle to efforts to improve teaching.

"Lack of time for preparation of classes - given other pressures of marking, research, etc."

"My teaching load has been heavy for someone who has had no prior teaching experience. I need more time to develop lecture material."

The impediment next in rank was the lack of institutional recognition and rewards for teaching.

"Very little importance is given to teaching as far as academic progression or promotion is concerned."

"Until the University rewards good teaching equally with good research there is a penalty for spending too much time on improving one's methods: it is only self-satisfaction."

Finally, respondents were asked what they regarded as the most important sources of support for the improvement of teaching. The experience and knowledge of colleagues (24) and the University's staff development unit (23) were identified most frequently, with students (16) being mentioned as the other significant source of support.

DISCUSSION

Allowing for the fact that an experience which extends over only a few hours is unlikely to have any dramatic impact, the results o' this survey indicate that the staff

development programme in question was of benefit to most of the participants who responded. The value attached to meeting with colleagues might be interpreted as reflecting the fact that the University of New South Wales is a large university with some 1300 academic staff and therefore offers very limited opportunities to share professional concerns with staff in other disciplines. It should also be said that this benefit is frequently noted in the on-the-spot evaluations of workshops.

Of more interest in relation to the impact of the programme and its potency for facilitating change are the claims regarding the gaining of insight into oneself as a teacher and becoming more aware of what might be achieved in the teaching role. These effects are likely to be both more enduring and more far-reaching in their consequences than the sharing of concerns and information.

Of special interest with regard to the further development of the programme is the low priority assigned to follow-up activities such as reading and contact with colleagues. This suggests that workshops should be self-contained in the sense that they do not depend upon participants undertaking further reading or other follow-up activities. Staff may be willing to devote a few hours to attending a workshop but the competing demands upon their time are such that few will be able to pursue suggestions and issues raised at the time. An alternative would be to link workshop activities more tightly with the practice of teaching so that effective follow-up is ensured.

A surprisingly large number claimed to have made changes to their teaching as a result of attending a workshop. These claims must be treated with some caution in view of the difficulty of attributing change to a single causal or facilitating factor. On the other hand there were 18 written comments which identified developing skills in teaching as the most important benefit gained. This indicates that, at least for some of the participants, there were some quite direct effects upon teaching.

The suggestions concerned with ways in which the programme might be improved indicate a high level of satisfaction. About 20%, however, expressed quite strong criticisms of the style in which the workshop sessions were conducted. This group was, in general, seeking a style which provided more structure, direction, information and solutions. They seemed to be looking for an experience which was rather more didactic in character.

To fully satisfy this demand would probably alienate many of those who did not voice it. But attention could be given to adjusting the design of workshops so that the structure and information content is increased. This is a delicate business because of the very wide range of interests, expectations and personalities which are represented at every meeting.

It is much easier, in principle, to satisfy the requests that the programme be oriented more towards specific disciplines and departments. There are many reasons for encouraging staff development activities which originate and are conducted in the departmental environment. These are more likely to address the immediate concerns of participants and thus be more productive of long-term effects. They will also be able to draw more fully on colleagial expertise and support.

Involvement in other forms of professional development activity related to teaching was reported by only a small number and the majority of thees responses were related to subject-specific conferences and seminars. The expression "staff development" is still not widely understood among academics and it may be that a re-worded question, perhaps with some examples, would have elicited a fuller response. A list of items could have been provided as with some of the other questions. However, more recent data have also indicated very low participation by UNSW academics in all forms of professional development activity related to teaching other than the workshops discussed here.

The responses reveal quite clearly the crucial importance of institutional rewards for and recognition of teaching. Because of a perceived lack of this many staff are reluctant to devote much time to developing their professional skills in relation to teaching. Academics have many competing demands upon their time and they are likely to give priority to activities which they see as being closely associated

with career advancement. This helps to explain why "lack of time" featured so prominently in the list of obstacles in the way of the improvement of teaching.

Despite the difficulties implicit in relying wholly upon self-report data the results of this survey do suggest that the programme has an impact which extends beyond the boundaries of the workshop experience. We cannot realistically expect a great deal to come out of a workshop which may extend only over three hours. On the other hand, if participants report subsequent changes in the ways in which they conduct their teaching this must be accounted as a substantial outcome. Reports of changes in attitude or ways of viewing the teaching role are even more significant because they could well have a continuing impact throughout many years of a professional career.

Finally, it is worth pointing out that, to the extent to which they succeed in bringing about long-term change, workshops are highly economical. An investment of a few hours of an academic's time may result in changes which have important consequences for the learning experiences of hundreds of students. Where this occurs, and our data suggest that it happens more frequently than we are apt to suppose, then the benefits of workshop participation are achieved at a remarkably modest cost in relation to total institutional budgets.

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APPENDIX A

Please indicate whether attendance at a TERC workshop/s has influenced you in any of the ways listed below. Make sure that you place a tick in one of the three columns beside each statement.

	YES	NO	N/A
I gained support for what I was trying to do			
I appreciated the opportunity to meet other staff			
I gained new ideas from other participants			
I realised others experience similar problems			
I have kept up with latest ideas and practices			
I have become more aware of the variety of resources available to me			
I now provide more feedback to students			
I now seek more feedback from students			
I followed up some of the ideas in the workshop through reading or through contact with others			
I subsequently made some changes to my teaching or course design or assessment procedures			
I subsequently tried a new approach in some aspect of my teaching			
I now consider using a greater variety of teaching techniques			
I became more aware of my own strengths and weaknesses			
I improved my ability to deal with a common problem I face			
I have become more aware of students' needs and interests			
I have developed greater self-confidence in handling certain situations			
I have thought more about what I am trying to achieve			
I am more conscious of the need to evaluate what I do			
I have extended my interest in teaching			
I have become more aware of alternative ways of doing things			

What do you regard as the most important benefits you obtained through your attendance at a workshop?

_____

_____

Please indicate in what ways you consider the workshop programme might be made more effective for you?

_____

_____

Have you been involved in any other professional development activities related to your teaching in the past three years? If so please indicate what these were:

_____

_____

Have any of the following factors inhibited your endeavours in any way in the improvement of teaching?

	YES	NO
Lack of funds		
Lack of equipment/materials		
Inadequacy of rooms/space		
Attitudes of colleagues		
Attitudes of my Head of School/Department		

	YES	NO
Attitudes of students		
Timetabling		
Course structure		
Lack of recognition/incentives for teaching		

Please elaborate on any of the above items which you feel are of particular significance in your situation:

_____

_____

What do you regard as the most important sources of support for the improvement of your teaching?

_____

_____

If you wish to add any other remarks on any of the topics covered here please do so on an additional sheet.

Thank you for your cooperation.

Name _____ Date _____

Report from the Symposium

Staff Development in the 80s: Changing Institutional Approaches

Organiser & Chairperson:
Alan Lonsdale
Western Australian Institute of Technology

INTRODUCTION

Prompted in part by the report of the Williams Committee of Inquiry into Education and Training, in which recommendations were made concerning the development of academic staff, there has been a mild surge of activity at the national level and within individual institutions. The purpose of this symposium was to examine some of these responses and to discuss alternative and changing approaches to the professional development of academic staff which might be more appropriate in the 1980s.

The Williams Report specifically recommended that the Australian Vice-Chancellors' Committee "appoint an expert working party to formulate programmes for staff in the theory and the practice of teaching, curriculum development and examining, and then later consider whether satisfactory participation in such programmes should become a normal condition of tenured appointment". In passing, it is noted that a similar recommendation was not made concerning the CAE sector.

The AVCC moved promptly to establish a working party, which published its report in 1981. The working party made a number of provocative and far reaching recommendations which have prompted both applause and criticism. Writing in The Australian's Higher Education Supplement, John Bremer described the report as "a courageous document" (August 20, 1981).

Some of its more controversial recommendations include compulsory induction programmes for newly appointed academic staff, reduced teaching loads for staff in their first year of appointment and the regular and formal evaluation of staff performance. The Federation of Australian University Staff Associations (FAUSA) quickly established its own Working Party to respond to the AVCC report; the nature of their response is described in a later section of this symposium.

Meanwhile, a number of universities (and some CAEs) around the country have been considering the recommendations of the AVCC report and some of this activity is also described in later sections of the symposium.

More recently, activity has commenced in the CAE sector. In response to a statement on the professional development of academic staff in colleges of advanced education prepared by the heads of educational development units in colleges, the Australian Conference of Principals of Colleges of Advanced Education (ACOPOCAE) has also recently established a working party, containing one member from each state. This working party has met once and hopes to complete its work by the end of 1982. It has adopted a comprehensive definition of professional development, relating this to all aspects of the work of academic staff - teaching, scholarly and research-related activities in specific disciplines, institutional leadership and service, and external service. In

particular, it aims to take a forward looking view through an examination of the range of forces and factors expected to affect the work of academic staff over the next five or more years and, in turn, the implications of these for staff development.

From these various activities, a number of questions and issues are starting to emerge. On the surface, it would seem that there is a growing awareness at the institutional level of the importance of staff development. However, one might ask whether this is really the case or whether the activity is largely cosmetic, with institutions being preoccupied with other matters such as finance, amalgamations or declining enrolments. The quality of teaching - and staff development - may be victims as institutional values adjust to other more pressing external forces, at least in the short term. It is observed also that in a number of institutions educational development units have been or are under review, or have had their budgets substantially reduced.

At the same time, it is apparent that the need for staff development is growing - if staff development is seen as being directed at assisting staff to maintain and enhance professional excellence in all their roles. For example, such factors as reduced career mobility, fewer promotional opportunities, increasing teaching loads and increasing uncertainty about the security of employment are all affecting the morale and motivation of academic staff. Opportunities to provide extrinsic motivation through institutional reward systems are decreasing. Intrinsic motivation, through the satisfaction or stimulation derived from teaching or research, may also be deteriorating in the face of reduced resources. Many commentators see such factors leading to a less motivated body of staff, who are still, in many individual cases, working in the same institutions in twenty or more years. Maintaining and enhancing the vitality of academic staff will emerge as a significant institutional challenge over the next decade or two. It may require the creation of alternatives to the traditional ways in which staff development has been pursued over the last ten or fifteen years, which has been a period of relative growth. Are these traditional approaches still appropriate? Should we be seeking to invent new approaches which are more responsive to changing circumstances?

In this overall context, speakers in the symposium reviewed some of the developments occurring around Australia and raised questions concerning alternative approaches to staff development. In the brief account of the symposium which follows, Australian commentaries and perspectives are provided by David Boud (University of NSW), Bob Ross (Griffith University), Bernard Hawkins (Swinburne Institute of Technology) and Bob Cannon (University of Adelaide). Finally, Christopher Knapper (University of Waterloo, Canada) provides an overall perspective in the light of his studies of staff development programmes in a number of overseas countries.

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David Boud: A STAFF ASSOCIATION PERSPECTIVE; DEVELOPMENTS IN NSW UNIVERSITIES

It might be imagined that the reaction of a professional association to proposals to enhance the skills of its members and to give support to one of their major roles would be one of enthusiasm. The fact that the reaction of FAUSA and of many of its constituent associations has been distinctly cool requires us to look carefully at the tone and nature of the AVCC Working Party recommendations, the context in which they were produced and the perception of staff associations of this context.

There are at least three aspects of the context of the Report which have influenced its reception:

(a) The origins of the concern for staff development in this instance came from the Williams committee through the AVCC to individual institutions. The Report can therefore be seen as an initiative external to higher education.

(b) Reduced funding, rationalisations and cutbacks in activity are currently occurring in higher education. Staff development thus places an extra burden on resources and staff time when these are in short supply.

(c) Reduced public and political support for higher education is apparent. There is now less pressure from student numbers, and more concern that universities should respond to outside pressures.

There is a climate of accountability which includes notions of checking up on staff and additional control on supposedly "free wheeling academics". Restrictions on study leave and the Senate inquiry into tenure provide examples of this. The AVCC report can be seen in this context as an additional measure to bash universities.

FAUSA interpreted the report in the light of these more general factors and reacted to its recommendations with much more suspicion than did those with responsibilities for staff development. Indeed, at one stage it appeared as if FAUSA might adopt a position of outright opposition to staff development, seeing it as a Trojan horse which would undermine conditions of employment and impose sanctions and barriers on academics freely going about their various tasks.

As it has turned out the stance of FAUSA is now mildly positive. The Representative Council meeting in February 1982

> discussed and carried a resolution in favour of the implementation of the AVCC recommendations supporting the clarification of letters of appointment, a reduction in teaching loads for newly appointed staff and the adoption of explicit procedures for formally advising probationary staff of their performance each probationary year. (FAUSA Newsletter 82/1 22 March 1982, p. 5)

In short, the non-contentious items in the Report have been accepted.

The same motion opposed the implementation of compulsory teacher training schemes for academic staff, but supported "appropriate voluntary induction programmes." It opposed the remaining recommendations.

Expressions of support were given for the review of academic departments and it was emphasized that universities should put their own houses in order through improving the quality of the institutional environment and engaging in sensible planning rather than focussing on implied allegations of inadeqaucy of academic staff.

There was no sympathy for what was referred to as the "stick and carrot approach to motivation" which some delegates believed was represented by the AVCC report. Opposition can therefore be expected towards anything which has connotations of compulsion, individual evaluation for institutional purposes, and limitations on advancement. I have heard the view expressed that improving the present lowly status of teaching in promotion decisions should be opposed on the grounds that to introduce additional criteria for promotion would provide an additional barrier at a time when quotas on promotion positions are being adopted.

Lest I have given the view that staff associations are adopting a reactionary and unenlightened position I must add my own observations.

I believe that FAUSA is correct in adopting a cautious position. The present initiatives did not originate from the universities themselves or from staff associations. Their adoption would represent a substantial innovation at a time when most other innovations are being hit by cutbacks and when it is becoming difficult to sustain some academic programmes. Staff development in the form that most academics would support - study leave - has been restricted and now tenure is being questioned by the Senate Standing Committee. To the politically naive the AVCC recommendations may appear to be something educationally worthwhile, but there are dangers - to university autonomy, to career progression and to "deviant" academics - if they are accepted uncritically and implemented hastily. The AVCC Working Party has done a valuable job in stimulating an important debate and giving succour to the people in universities who are promoting staff development. It would be unrealistic to expect there to be substantial change in essentially conservative institutions on the basis of it. Of course, if external

pressures on universities were to increase substantially the strategy of being seen to "put one's own house in order" by taking staff development seriously might become increasingly attractive.

Some developments in NSW universities

In preparing for this contribution I asked some of my colleagues in other NSW universities how their instituions have responded to the AVCC report and what initiatives were planned.

The response was very diverse, ranging from apparent inaction (New England, Woollongong) to the formation of various committees to examine some or all of the recommendations (Sydney, Macquarie, New South Wales). In those institutions without existing induction programmes (Sydney, Macquarie) there does seem to be an interest in establishing these. At Macquarie an induction programme was started earlier in 1982 arising from the impetus provided by the Report.

At New South Wales the Vice-Chancellor has formed his own Working Party on Staff Development to make recommendations and appears to be giving it his support. Although no recommendations have been made as yet the UNSW Working Party is taking its job very seriously and has conducted surveys of new and existing staff to provide it with current, local data to inform its decisions. Support from the Staff Association also appears to be the greatest at UNSW which is not surprising as the major staff association submission to the AVCC Working Party came from them.

* *

R.A. Ross: GRIFFITH - A DIFFERENT PERSPECTIVE ON THE ROLE OF AN EDUCATION UNIT

A comprehensive staff development policy should cover all activities of staff. In a university these will include teaching and research, probably combined with contributions to the running of the institution at various levels (usually labelled by the blanket term 'administration') and possibly a contribution to relations with the community (including the professional or discipline organisations outside the institution). Responsibility for the full range of policies and activities designed to aid staff to develop their expertise in all these fields rests with the institution.

Recent reports have strongly suggested that institutions should compile specific policies. Whether they do or not, institutions clearly have the responsibility for ensuring that the possibility of staff development exists and is encouraged. In times of financial pressure the effectiveness of the staff of an institution is vital, staff being the major resource of the institution (consuming typically up to 80% of the recurrent budget in salary costs).

Where an education unit exists it is likely to have responsibilities for staff development but its responsibilities can only ever be a sub-set of the full institutional responsibilities. Typically the unit's staff development responsibilities will fall in the area of teaching. A unit's responsibility in the teaching area is usually restricted to undergraduate teaching although help in postgraduate 'teaching', that is research supervision, is far too often ignored. However, even if restricted to under-graduate teaching a unit can see its role as being involved only in presentation techniques or perhaps in course design and assessment techniques but only at the general abstract level. Teaching clearly involves a much wider range of activities than merely presentation, and presentation a much wider range of techniques than lecturing, or even lecturing and tutoring. Instructional design and the assessment of student achievement are as important as presentation activities and any respectable teaching will also involve formal or informal review activities. As these are the activities which constitute 'teaching' the most effective way to help staff develop

their expertise in these activities is to work closely with them while they are carrying out the actual activity.

Another important procedure is to guide staff in the performance of their tasks and institutions can do much by deliberate institutional procedures as well as by general attitudes to help condition the ways in which staff perform their teaching functions.

Much emphasis is put on the importance of institutional reward structures in influencing the effort that staff put into their teaching. This emphasis ignores the fact that for most staff (particularly in universities) external rewards in terms of recognition and acceptance by intellectual colleagues are more important. It is probable that internal reward systems closely mirror these external rewards in practice, no matter what internal procedures are used.

However, as stated above, the influences on how staff perform their teaching function are much wider than the internal reward system. Institutional attitudes, policies and procedures in the areas of course approval, assessment, board activities and review procedures are probalby much more effective.

The message for units from this analysis is that they should see their role as assisting the institution (and its staff) to produce the most effective academic programme possible (which is after all what the teaching function is about) and that two types of activity contribute to this. One is influencing institutional policies and procedures and the other is working with staff in carrying out those policies and procedures. Both activities contribute directly to achieving the academic goals of the institution and both are important contributions to staff development.

* *

Bernard Hawkins: REACTIONS OF VICTORIAN INSTITUTIONS TO THE AVCC WORKING PARTY REPORT

The various reactions which are briefly summarized below were obtained in early April, 1982. Further developments may have occurred since that time.

University of Melbourne

No direct action was reported from the University. The Staff Association will be considering the Report. The Advisory Board of the Centre for the Study of Higher Education endorsed comments in the Centre's Annual Report to the effect that any move towards compulsory attendance at courses or formal evaluation would change the role of the Centre, and that this was not desirable.

Monash University

The Report had been considered by Professorial Board, which noted that some of the recommendations were already implemented (either formally or informally), and that it did not intend to change where recommendations were contrary to current policy (for example, recommendation 4, which proposes a revised salary structure providing greater incentives for superior performance). The Board expressed concern at a number of the explicit and implicit assumptions contained in the Report.

Latrobe University

The Vice-Chancellor is using the Report to support his attempts to introduce staff development activities; a part-time seconded staff member will be working in this area in the near future.

Royal Melbourne Institute of Technology

The Registrar has sent copies of the report to departments. The Staff Development Committee has not discussed the report, although Professor Brian Wilson (Chairman of the AVCC Working Party) has been invited to speak on the Report at the Institute. The Report will be discussed at Academic Board. Departmental reviews will be undertaken, on a trial basis.

Swinburne Institute of Technology

The Report has been distributed to the Committee of Inquiry into the future of the Education Unit, and will be considered by the Committee in making its recommendations.

Footscray Institute of Technology

Although the Report has been circulated at Directorate level, no action is reported as yet.

Lincoln Institute of Health Sciences

The Report has been tabled at Academic Board and noted. No impact is reported.

Chisholm Institute of Technology

Institutional policies on staff development had already been established; no changes were expected arising from the AVCC Report.

Warnambool Institute of Advanced Education

Some developments - for example, a staff self-improvement plan - were underway before the Report arrived. The Report itself had not yet had any impact.

Gippsland Institute of Advanced Education

It is expected that the report will be discussed within the Institute over the next few months.

* *

Robert Cannon: DEVELOPMENTS IN SOUTH AUSTRALIA

Introduction

Academic staff development enthusiasts who might have hoped that the AVCC Working Party recommendations would have significantly changed institutional approaches to staff development in South Australia will be disappointed to know that relatively little has changed. The emphasis, however, must be on the word 'relatively' because there are, I believe, evolutionary changes in academic staff development at Adelaide University which augur well for the future. However, before developing this line further, it is necessary to briefly outline the present institutional pattern in South Australia.

Higher Education in South Australia in 1982

One year ago there were eight institutions of higher education in the state. There are now five: Adelaide and Flinders Universities, The South Australian Institute of Technology, the multi-campus South Australian College of Advanced Education and

Roseworthy Agricultural College. Only one of these institutions (Adelaide) has an active staff development unit, the Advisory Centre for University Education (ACUE). Flinders still has its Educational Research Unit 'on the books', but unmanned, and the SAIT has appointed a member of its academic staff to its Management Services Branch with a brief to investigate professional development as well as being involved in general personnel work.

Developments at the University of Adelaide

The University's major policy committees declined to examine the AVCC Working Party recommendations in detail, and were content to resolve, inter alia,

> that it would be appropriate for the Vice-Chancellor, in consultation with Chairmen of Departments, to encourage all full-time and part-time members of the academic staff, particularly new appointees, to take advantage of the services offered by the ACUE.

The Vice- Chancellor has acted on this resolution and has written to all Chairmen in the following terms:

> One of the functions of the Advisory Centre for University Education (ACUE) as established in 1973 is to assist in activities related to academic staff development. In recognition of both the importance of teaching and of the role of the ACUE in the University, Education Committee resolved at its December 1981 meeting that I, in consultation with Chairmen of Departments, encourage all full-time and part-time members of the academic staff, particularly new appointees, to take advantage of the services offered by the ACUE. I think this is an important area and one to which we should pay careful attention and, as a matter of course, I propose to write to new appointees about the ACUE. Whilst a number of the AVCC Working Party proposals have not been fully supported, the arguments for undertaking staff development are generally well supported. These arguments, taken together with ACUE's commitment, should commend the merits of staff development to us all. It is my view that much can still be done to enhance the effectiveness of teaching with the University.....
>
> (He enclosed a copy of the synopsis of the Working Party reprint and the ACUE Directory of Services with his letter).

Reaction to the letter has been mild but, nevertheless, supportive. Several Chairmen have commented favourably on the Vice-Chancellor's support, others have written declaring how valuable they have found staff development activities, and some hold the view that his expression of support should have been much stronger. But the most worthwhile outcome, in the short time, is that it has endorsed the role of the Advisory Centre for University Education in academic affairs at a time when there is an ever present threat of internal 'rationalization'.

The University is currently reviewing its statutes governing academic staff and it is almost certain that the length of the probational period for new staff will be increased to 4 years and that there will be a strengthening of academic evaluation criteria.

Flinders University: This University is also reviewing academic staff matters and is considering an extension to the probationary period from 3 to 4 years. It is also making efforts to take teaching performance fully into account in decisions about re-appointment and promotion.

Conclusion

At the beginning of this paper, I claimed that there were evolutionary changes in academic staff development at Adelaide University. If I may be permitted to continue the natural science metaphor further, I believe (as Colin Flood-Page is reported to have remarked elsewhere) that we work on a geological time-scale with respect to staff development. Thus, the evolutionary changes - or perhaps developments is a better description - are these:

- staff development ideas continue to be actively pursued in the University of Adelaide;
- the Advisory Centre for University Education has received a formal 'vote of confidence' in its staff development work both from the major policy committees and from the Vice-Chancellor;
- the recommendations of the AVCC Working Party have been distributed widely and have been, in general, favourably commented on.

Small beer, perhaps, but at least the developments are in the general direction of the intentions of the Working Party's report.

* *

Christopher Knapper: STAFF DEVELOPMENT: A GENERAL PERSPECTIVE

Although teaching is a major activity of most universities and colleges, it is a truism that hardly any lecturers at tertiary level institutions have received any formal training in instructional methods. The establishment of units to work with staff on the improvement of teaching and learning is a comparatively recent phenomenon, dating from the mid-1960s. Such units now exist in a great number of institutions throughout North America, Western and Eastern Europe, Australasia, and in some developing nations. In 1973/4 I made an informal survey of the growth of staff development units in Canada, the United States, Australia and New Zealand, and I have recently revisited those countries in an attempt to monitor changes that have taken place in the intervening years.

Since 1974 the climate in tertiary education has altered considerably. In particular, the past decade has seen a period of substantial financial retrenchment, a flattening or even decrease in student enrolments, and public disenchantment with the benefits of higher education. Although such a situation might be thought to augur an increased concern with the quality of teaching, in fact the economic and political climate has resulted in widespread constraints on staff development activity. For example, in the USA many of the units that were supported by millions of dollars of foundation grants have seen the disappearance of these funds almost overnight and the consequent demise of many well known staff development centres. In Britain and Canada the major coordinating bodies for instructional development have recently been disbanded. In Western Europe there is very little staff development activity apart from a few centres in Switzerland and Germany. In comparison, staff development in Australasia appears to be surviving reasonably well. While there have been no closures of staff development units in Australia and New Zealand, there has been an increasing scrutiny of such centres, and many of them have witnessed significant cut-backs in budget and personnel. The reasons for this widespread decline in staff and instructional development cannot be attributed solely to the financial climate affecting tertiary education. In part they probably reflect a failure of instructional development units to make a major impact upon the practice of teaching and learning in colleges and universities. There are several components of this problem, some of which are attributable to staff developers themselves, and others related more to the general climate within which developers must operate.

In the last category is the institutional reward system, which still places much more emphasis on research and scholarship than on teaching performance - although this could conceivably change as the number of staff positions diminishes, and if employers of tertiary graduates become more vocal about the quality of education the latter are receiving. Another aspect of the institutional context is the fact that participation by staff in instructional development activities is nearly always voluntary. In most institutions only a small proportion of the staff take part, and often these are the better, more motivated teachers. It is interesting that despite the

present rather gloomy climate for staff development, there are some current examples of thriving programmes that involve compusory participation by teaching staff - for example, in Eastern European countries such as the German Democratic Republic (where staff are required to take part in development programmes lasting several months at regular intervals throughout their careers) and in the British polytechnics (where staff are given release time to take part in mandatory induction programmes over the course of the academic year).

In addition to these institutional constraints, the failure to change methods of teaching and learning in higher education can also be blamed in part upon staff developers themselves. In particular, we have tended to concentrate instructional development efforts on the processes of education rather than the goals. For example, major activities for many units involve workshops on teaching techniques - as opposed to, for instance, trying to give staff insights into how students learn, the learning problems they encounter, how best material learned in university can be transferred to the real world, and so on. Staff developers have traditionally involved themselves rather little in curriculum matters (albeit for good political reasons), and hence have forfeited the opportunity to influence instructional content and instructional outcomes - for example, by forcing an examination of how what is taught can equip students with the lifelong learning skills they will need to function successfully in a rapidly changing society.

Do the AVCC Working Party recommendations offer a solution? In some respects they may, although caution is needed. For example, induction courses may be good or bad; in the UK where courses have often set a bad example of effective teaching, they may have had a negative effect. Further, compulsory participation in induction couses may not succeed in most Western institutions, even though it appears acceptable in Eastern European universities and in the British polytechnics.

Although embattled, the staff development movement still survives. If it wishes to do so in the future then quite a different model may be needed - a model not of staff development, instructional development, or even organizational development, but one of educational development, in which units concentrate less on the minutae of teaching techniques, and try to extend their influence on educational policy affecting the goals and quality of learning within the institution. The extent to which developers can persuade staff colleagues to think about such issues and to initiate change has important consequences for the survival of staff development units and for the future of tertiary education.

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Chapter 2:
EVALUATING COURSES

Every conscientious teacher seeks information which will serve to indicate the extent to which desired student learning is being achieved. This knowledge can then be used to modify course content and change teaching and learning activities in ways which will help students to learn more productively. Lublin and Bawden describe how they went about evaluating a new agricultural degree programme by examining how the experiences of students related to the key elements in the design of the programme. Course designers are often unaware of how students perceive the importance of what they are studying. Gabb and Mander report student ratings of the aims of laboratory work and discuss the implications of these for the design of laboratory activities. Laboratory teaching was also examined by Guthrie who reports an illuminative evaluation of the practical work in a biology course. A quite different approach is described by Andresen: this involves systematically trimming the content of a course so that it can be taught in less time by emphasising only the educational essential elements.

Those working in the technical education sector are very much aware of the significance of evaluative data in helping to ensure a close fit between the demands of the job-market and what is offered in training programmes. The papers by Montague and Putt discuss the findings of surveys designed to reveal connections between course completion, student characteristics, and subsequent employment. Information of this kind can contribute both to course design, vocational counselling, and enrolment policies.

Evaluation of Innovation: An Example from Agricultural Education

Jackie Lublin, University of Sydney
Richard Bawden, Hawkesbury Agricultural College

ABSTRACT

When an innovative curriculum is introduced there is a moral imperative to assure that it is subjected to rigorous evaluation as it develops. This paper reports on an example of the integration of illuminative evaluative procedures into an innovative degree programme in agriculture. The distinction is made between formative and summative evaluation and the role of each in the programme is indicated. Nine basis tenets are recognised as forming the philosophical basis of the degree and examples are given demonstrating how they are translated into learning experiences. The results of some evaluative investigations into the effectiveness of these experiences are quoted and interpreted.

J.R. Lublin, B.A., M.Ed., Senior Lecturer, Centre for Teaching and Learning, University of Sydney. She recently moved to Sydney University after four years at the New South Wales Institute of Technology as Head of the Educational Development Branch. She has worked in the area of educational development for ten years in Victoria and New South Wales.

R.J. Bawden, B.Sc.(Agric.)(Hons.)(Lond.), Ph.D.(Qld.) is the Head of the School of Agriculture at Hawkesbury Agricultural College. He was previously an academic at the University of New England and a research parasitologist in industry in the United Kingdom and part of a team for the Food and Agriculture Organisation of the United Nations at the National Veterinary Laboratories, Uruguay. He has published over fifty papers dealing with parasitology and with agricultural education. Current interests are curriculum design and systems approaches in agricultural education.

Address for Correspondence: Dr. R. Bawden, Head, School of Agriculture, Hawkesbury Agricultural College, Richmond 2753 N.S.W.

INTRODUCTION

When a curriculum is designed and implemented in such a way that it differs in fundamental aspects both from preceding programmes of its own kind and from most programmes of other kinds, then it becomes both educationally and morally imperative to evaluate its progress and outcomes. Questions such as:

- Is this programme as effective as it can be?
- Is it operating as it was designed and are the outcomes close to those that were desired?
- Is this innovative programme a better one than an identical conventional programme?

Implicit in the design and conduct of innovative educational programmes then is a system of evaluation which allows the programme objectives to be monitored and judgements made about their progress and outcomes. These evaluations must be more than the common informal evaluation based on the self judgement of the academics involved.

It was an early decision of the Board of Studies of the School of Agriculture at Hawkesbury Agricultural College to integrate formal evaluation processes into its innovative educational activities.

This paper will discuss some of the ways in which that resolution has been carried out.

Definition of Evaluation

Evaluation is defined as the process of collecting data or evidence about issues or objects and then placing a value on, or making a judgement about them, based on that data or evidence. Formal evaluation of education is often recognised by its dependence on check lists, structured review by peers, controlled comparative studies, and standardised testing of students (Stake, 1967).

Summative evaluative judgements are final and considered statements on the worth or value of a completed outcome of some sort such as a task, unit, module, semester or total programme. It is frequently important to evaluate ongoing situations however. Formative evaluations do provide data which can be fed back immediately into the system under review as a basis for adjustment and improvement. This is particularly necessary when the system is innovative. The challenge at Hawkesbury has been to develop formal summative and formative procedures that can be incorporated into the activities of the School so that the learning outcomes of the students and the effects of innovation can be closely monitored as a basis for adjustments.

The initial major thrust of evaluation has been to sensitise each academic to the need to match what he or she intended to do within the perspective of the programme with what was actually done; that formal evaluation of such performance was as integral in the educational process as assessment of student learning performance.

The Hawkesbury Environment

For the past four years the School of Agriculture at Hawkesbury has been redesigning a family of courses at the Associate Diploma, Undergraduate Degree and Post Graduate Diploma levels in agriculture and horticulture. Whilst the content details of such programmes obviously differed, a number of fundamental tenets were accepted as the guiding philosophic principles of the educational process in the School. All learning experiences and curricular activities including formal evaluations were designed around this philosophic framework. The tenets of the learning environment are as follows:

- That the School's intellectual map of agriculture perceives it as "the basic interface between human societies (social systems) and their environment (natural systems)" (Dahlberg, 1979).

- That a systems approach is "fundamental to the teaching of agriculture and not merely an addition to it" (Spedding, 1981).

- That education can have a profound impact on the rate of productivity growth of Australian agriculture and that this can be a most desirable goal for those in the rural sector (Swain and Bawden, 1981).

- That the "life roles which (agricultural) graduates will enter can be described and translated as competencies, and that decisions concerning what constitutes adequate demonstration of ability or performance in these roles can also be made"(Grant et al, 1979).

- That the ability to be self directive in one's own learning is "a basic human competence that has suddenly become a prerequisite for living in this new world" (Knowles, 1975).

- That learning based on the first hand experience of the learner through his or her involvement in an experiential base is fundamental to the provisions of an effective learning environment (Boud and Pascoe, 1978).

- That the role of the academic is most effective as a facilitator of the learning process rather than the fount of all that is worth knowing about a specific discipline (Rogers, 1969).

- That problem solving is a fundamental human ability which is remarkably similar if not identical to the process of effective learning (Kolb, Rubin and McIntyre, 1974).

- That curricula are most effective when they are based around a series of central issues or philosophies which serve as integrating perspectives for learning (Bruner, 1960).

Having the tenets was one thing, designing feasible programmes about them was quite a different issue. Three such programmes are up and running and two more are planned for the relatively near future. For the remainder of this paper we shall concentrate on the UGl Degree programme in agriculture. This innovative programme in many respects is similar in form and impact on students, observers and the professional environment, as the Newcastle Medical Degree programme. The statement of general course objectives for the programme are unusual almost to the point of being extraordinary. Amongst those in the affective domain, for instance, they mention that graduates of this programme will demonstrate:

- *Awareness of the importance of informed attitudes about technological and social systems.*

- *Awareness of self in terms of a spectrum of attributes and potential for development.*

- *Sensitivity to the attributes and needs of others.*

- *Independence for learning combined with a sensitivity for co-operation in group activities.*

- *Empathy, objective inquisitiveness and rationality.*

- *Sensitivity to changing circumstances and the need for adjustment.*

The incorporation of objectives of this sort into the programme is a reflection of both the vocational attributes of a professional agriculture consultant as well as the broader philosophic issue of learning for total personal development. This affective dimension of the programme has certainly created specific challenges for

student assessment and for programme evaluation.

General objectives in the cognitive and psycho-motor domains have also been developed.

Cognitive Objectives

Graduates of this programme will have achieved demonstrable competencies in knowledge and understanding of:

- *The farm as a commercial, man-managed production system.*
- *The farm as the interface between socio-economic and environmental systems.*
- *The scientific basis of agricultural technology and innovation.*
- *The application of appropriate agricultural technology to achieve productivity growth.*
- *The manipulation of technological, social, political, economic and environmental factors to influence agricultural productivity.*
- *The economic basis for the allocation of resources in agriculture.*
- *The impact of agriculture on social and environmental systems.*
- *Effective decision making and problem solving under conditions of imperfect information.*
- *Effective inter-personal communication techniques and appraisal.*
- *The principles and methods of systems analytical techniques.*
- *The theories of learning as a life-long process for self-actualization with social responsibility.*
- *Goal and problem based reflective observation and learning.*

Judgements concerning just what is meant by acceptable levels of competency in achieving these objectives are based on perceptions of employers, graduates, the learners themselves, peer academics and the academics of the institution itself. A similar profile relates to psycho-motor skills.

Psycho-Motor Skills

Graduates will have demonstrated acceptable competencies in:

- *The performance of an appropriate range of operations and husbandries associated with technological agriculture.*
- *The performance of an appropriate range of laboratory analytical techniques relevant to the applied sciences of agriculture.*
- *The performance of appropriate skills in the manipulation of micro and main frame computers.*

In addition to these general objectives more specific ones were generated for all three domains across each of the five phases of the degree programme. These in turn were used as the basis for the design of appropriate learning experiences using a wide variety of experiences and methodologies. Some of these details have been discussed elsewhere (Bawden, Drinan and Lundie-Jenkins, 1981). They do relate to the nine fundamental tenets and form a most appropriate basis for both the assessment of learner performance and the evaluation of the effectiveness of the programme.

In essence the programme has been developed around major themes for each of the five phases. Each of these in turn has been divided into a series of problem-based task units themselves with themes and intents. Behavioural objectives are described for each task unit and assessment is based on the achievement of such objectives. Furthermore, each task unit is conducted using one or more experiential bases exemplifying natural, social or production systems.

The task units are currently sequenced and although there are many arguments to increase the flexibility of this sequence resource availability currently constrains this ideal. The formal tasks are complemented by self directed learning contracts negotiated by each individual student with his or her facilitator. In approximate terms these contracts constitute ten per cent of the student's time commitment and twenty per cent in phase II. This proportional time allocation continues to increase as the programme progresses. Phase V is competency based around a vocational goal. It is probable that this entire phase will be conducted through negotiated learning contracts.

Academics act in two major roles - as facilitators of the learning process and as resource people designing and conducting both task units and contracts. Each group of ten students has allocated to it a facilitator for an entire phase. In this context the academic acts as a learning counsellor concerned as much with the process of learning of each individual in his group as with the content. He or she also facilitates the group process as an input into the development of some of the affective abilities previously outlined such as sensitivity, empathy and inter-personal communication skills.

The learning methodologies that are adopted cover an extremely wide range reflecting personal preferences and abilities of individual academics and, at least in the contract studies, of the learners themselves. A general overview of the structure of the programme is shown in Table I. The more specific themes of the sequenced problem-based task units within phases I and II are as follows:

Phase I

1. Orientation to the programme philosophies and methods.

2. Why agriculture?

3. Agriculture and natural ecosystems.

4. What is agriculture about?

   (a) The consumer/producer relationships.
   (b) The producer's response to consumer demand.
   (c) Harvesting.

5. The dairy farm as a production system.

   (a) The plant production sub-system.
   (b) The animal production sub-system.
   (c) The plant harvesting sub-system.
   (d) The animal harvesting sub-system.
   (e) The management sub-system.
   (f) The social system.

Phase II

1. The farm as a dynamic production system.

2. The farmer, his production system and the social and environmental systems with which he interacts.

3. The environmental impact of farming practices.

4. Change and the farmer.

TABLE 1

An Overview of the UG1 Degree in Agriculture at Hawkesbury

Phase	Wks	Major Theme	Main Experiential Bases		
			Social Systems	Environmental Systems	Agricultural Systems
I	32	The description of the form and function of social, environmental and agricultural systems: their comparisons, contrasts and inter-relationships.	The facilitated learning group.	A reserve close to the campus.	The College dairy farm.
II	16	The analysis of the dynamics, operations, allocations and innovations in agricultural production systems and their impact on environmental and social systems.	The learning group. Other College groups. Interviewed groups.	The environs of the College. Others off campus.	Other College and off-campus farms. Other agricultural systems.
III	16	An action project case-study on the phase II theme conducted off-campus on a commercial agricultural production system.	The host farm family. The local community.	The environs of the host farm.	The host farm and others in the locality. Other agricultural systems.
IV	16	The analysis and simulated development of agricultural systems within the context of commercial realism and social and environmental responsibilities.	A diverse range of agricultural, social and environmental systems.		
V	32	The acquisition of a vocational competency based on an appropriate model from the agricultural industry.	A range of systems appropriate to the chosen competency model.		

Evaluation of the Programme

Planning and incorporating formal evaluative procedures in this innovative course commenced during its first year of operation in 1981. The challenge was to make provision for both formative and summative evaluation although its immediate need seemed to be for formative evaluation. In real life the distinction between these two forms of evaluation blurs; clearly, some of the distinctively innovative objectives could not possible be evaluated until graduation or after (e.g., "the graduate as a self-directed learner"). Nevertheless a state-of-the-art type of evaluation in the first year could still give important indications as to the orientation towards these intents. Other innovations can be evaluated inferentially in an ongoing way at this early stage in the programme's development ("the student as a learner and as a group member"; "the academic as a facilitator").

The approach to the incorporation of formal evaluation was based on the theoretical considerations of Parlett and Hamilton (1972). Their model of the evaluation of innovation they described as "illuminative evaluation". They have likened the approach to that of the anthropologist and have distinguished it from that of the botanist, viz., their evaluator is a participant-observer, not an experimental researcher. In this model the evaluator takes the complexities of the real life situation as a given, and attempts to describe and illuminate it. He does not attempt to control or manipulate variables and as such is at some variance with the approach of Stake (1967).

This approach is consistent with the systems perspective of the programme particularly as they relate to what Checkland has referred to as "soft systems analysis" (Checkland, 1972). This relates to the analysis of problems in goal oriented human activity systems such as business organisations, firms or any other social grouping.

A significant feature of the Hawkesbury evaluation model is that it is not to be conducted on an ad hoc basis by an external "anthropologist"/observer. The procedures are to be routinely incorporated into ongoing programmes. In essence such procedures are intended to gather appropriate data and evidence which can be used to describe and illuminate the realities and the effectiveness of the new course. This provides a base line for judgements and subsequent adjustments to the programme whenever this is appropriate to more effective learning.

An illuminative evaluator starts out with an open mind concerning the value and relevance of evidence. His opinions about this are constantly revised in the light of the evidence collected. In other words, the data collection process is one of progressive focusing. One of the many design features of evaluation of this programme has been that although routine procedures needed to be devised, the evaluation procedure in general needed must be flexible enough to allow for further follow up and for the investigation of unpredicted outcomes.

Procedures

Of all the many questions that could be posed as intrinsic to the evaluation procedure it seemed, on reflection, that the most fundamental judgements that could be made about the programme would be those made in response to the following two questions.

A. How good/effective is this innovative programme?

B. Is this innovative programme better than an identical conventional programme?

These fundamental questions generated a more expansive list of major questions which would need to be answered before summative judgements could be made.

A. How good/effective is this innovative programme?

In order to give a summative evaluative answer one would need to ask:

A1. What does it say it is doing and what are its stated intents?

A2. Are these intents valuable/worthwhile?

A3. Is it doing what it says it intended to do?

A4. Is it doing this well/effectively?

B. Is this innovative programme a better/more effective one than an identical conventional one?

In order to give a summative evaluative answer one would need to ask:

B1. What are the innovations?

B2 Are they based on acceptable theory?

B3. Empirically how well are they working?

B4. How satisfied, with the innovations of the programme, are

(i) the learners,
(ii) the academic staff,
(iii) graduates?
(iv) employers?

B5. How well do graduates of this programme perform compared with graduates from conventional programmes?

Formative, ongoing evaluative questions can be derived for most of the above which can help to illuminate the programme in its present state and provide a basis for adjustments towards an eventual summative evaluative verdict.

As stated previously there are two phases to evaluation - the gathering of evidence and the making of judgements. While these two functions are often performed by different bodies, there appears to be a need for a strong link between them: the body making the judgement must be able to specify the evidence on which it wishes to do so, especially after a first scrutiny of routine data. However, by the same token, independence and credibility must be preserved by the judging body.

At Hawkesbury the summative judgements must be made ultimately by the body responsible for controlling the programme. Ongoing formative judgements will be made by a range of individuals and groups, from the individual student to the Head of School and it has already been seen that the evidence on which these judgements will be based must be routinely collected and scrutinised.

The forces of evidence as a basis for making judgements will include:

1. The statements of programme, phase and task objectives and philosophies.

2. Entry characteristics of students.

3. Academic progress records of students.

4. Examples of students' work especially of their portfolios of personal development.

5. Opinions about the course from students,
staff,
programme co-ordinator,
Head of School,
observer,
graduates,
academic moderators,
advisory group members,
agriculturalists.

6. Graduate performance, career path, influence on the profession and industry.

Progress

The initiation of the formal procedures was conducted through a series of workshops with staff and students involved during the second semester of the first year of the programme (September, 1981). An overall philosophy of approach and methodology for evidence collection and judgement emerged during these discussions which were co-ordinated by one of us (J.L.).

It was decided that there were seven major innovations in this programme that could be associated with the fundamental tenets and the general and specific objectives. These can be summarised as:

- *Group based co-operative learning.*
- *Criterion referenced assessment.*
- *Academics as facilitators of the learning process.*
- *Problem centred/integrative/experiential learning.*
- *Systems perspective and organisation within the programme.*
- *Personal development/portfolio.*
- *Learner autonomy/learning contracts/competence.*

The sources of information served as a basis for the design of questionnaires. These were formulated and circulated to students and to the academics who had been involved in the programme in varying roles.

The results of the initial investigation of students and facilitators are displayed in appendices I and II.

This formal evaluation had been preceded by many instances of informal "soul-searching". A feature of the programme in fact was a weekly meeting of the entire student enrolment with the course management team as a Course Council. Interviewing techniques and group processes such as the nominal group technique were also integral learning experiences in the analysis of the social systems components of the course programme. Most of the results of the first formal evaluation were therefore not unexpected.

Many indeed had already been used as a basis for adjustment. It was particularly true for the issue of effective facilitation as well as for the provision of feedback to students following formative assessments of tasks and problems. The anxiety associated with feedback was a particular characteristic of the programme almost throughout the entire duration of the first year of the programme. It should be emphasised that most of the staff were inexperienced with many of the innovations of the new programme. Furthermore, almost without exception, they still had heavy teaching commitments in the old style diploma programme which had been subsumed by the newcomer degree. It is also true to say that this situation was exacerbated by the attitude of the continuing students who certainly bore some resentment at the fate of their programme.

It is an interesting reflection that as formative assessment becomes an integral part of the learning process so the expectations of the learners for feedback on their performance becomes greatly heightened. Informal evaluations would lead us to believe that subsequent adjustments to the programme have alleviated much of the anxiety expressed by the continuing degree students now in their second year. However, assessment has already become a very significant issue with the second generation of first year students. It will be most interesting to compare and contrast the next formal evaluation which will be conducted at the end of the first semester using the identical instruments as previously.

There have been a number of workshops relating to the further development of academics as facilitators. Considerable confusion and associated ineffectiveness is still associated with the process of facilitation. In a sense this is not surprising as it is very much a matter of personal style. There is, however, an encouraging consensus that the facilitator should, in the main, be concerned with the process of reflective learning and that facilitators are thus learning consultants and counsellors to both individuals and groups of students.

Concluding Remarks

Formal evaluative procedures have been incorporated into the innovative educational programmes in the School of Agriculture at Hawkesbury Agricultural College. They are being used in the formative sense as the basis for adjustments in the learning environment. They will also be used when summative judgements are necessary. There is little doubt that the academic staff and the enrolled students all perceive the absolute necessity for objective evaluation to be made as the programme is so radical in both content and process when compared when any of its predecessors anywhere in Australia. It has become relatively common practice for academics who are associated with major tasks in the programme to conduct illuminative evaluations of such experiences. Conclusions drawn from analysis of such data is regularly fed back to the students. Such impressive interactions between academics and learners have had many advantages and strong interdependent bonds have built up in most instances.

Formal evaluations are complemented by many informal investigations. It is important that such moderations remain in context and do not become ends unto themselves. It is generally considered that at this juncture in the development of the programme evaluation is a critical element of moderation as well as a moral responsibility for all involved.

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UGI EVALUATION APPENDIX I

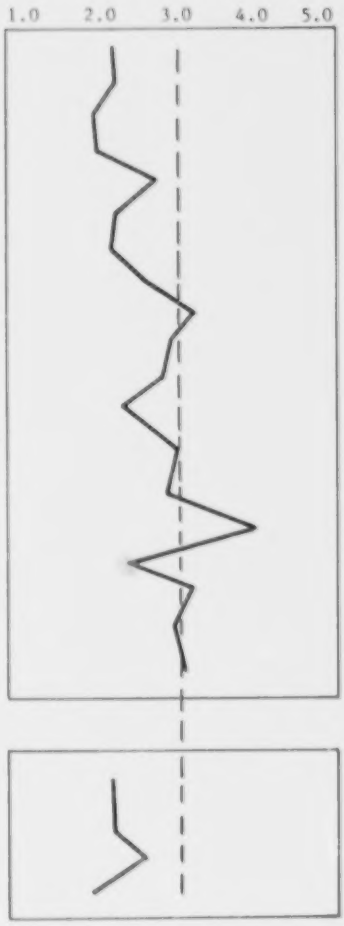
We are anxious to evaluate this programme to assure that the goals we have set are being achieved at an acceptable level.

We ask that you respond to the appropriate questions, rating your answers on the scale of 1 to 5 where 1 = highly satisfactory, 5 - highly unsatisfactory, and 3 - acceptable.

FOR STUDENTS

Are you as a student satisfied that you are -

1. Learning effectively?
2. Setting/being given realistic learning goals?
3. Taking responsibility for your learning.
4. Being an effective group member?
5. Making effective use of your facilitator?
6. Asking questions when you don't know?
7. Being helped when you ask for help?
8. Getting appropriate - field experiences?
   laboratory experiences?
   farm experience?
   managerial experiences?
   problem-solving experiences?
9. Being given an adequate opportunity to demonstrate your knowledge and skills?
10. Being fairly assessed?
11. Being given timely and relevant feedback?
12. Satisfying the personal development requirements?
13. Always clear about what is expected of you?
14. Able to get acceptable access to resources?
15. Satisfied resources available are adequate in terms of their relevance?



CONCERNING YOUR FACILITATOR

16. How interested in you as a person is he?
17. How helpful is he when he is with your group?
18. How accessible is he to you as an individual?
19. How helpful is he when you see him personally?
20. In the past semester what did you find -
    most interesting?
    least interesting?
    most difficult?
    easiest?
21. What is your biggest gripe?
22. What is your biggest joy?

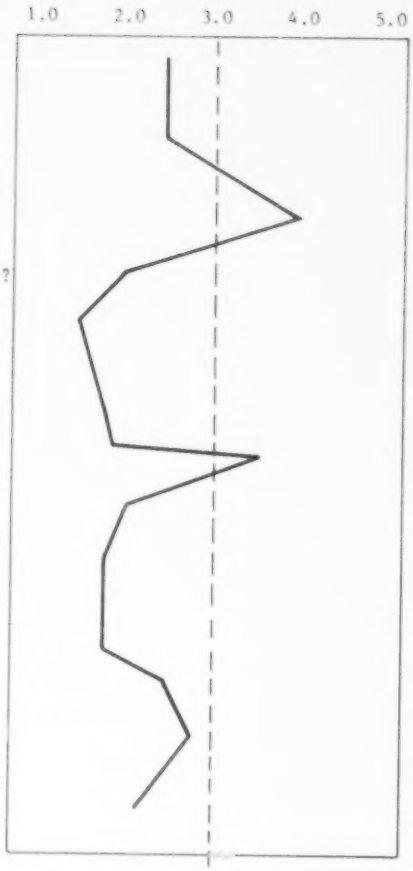
n = 58 (80.5% sample)

FOR FACILITATORS

APPENDIX II

Are you as a facilitator satisfied that -

1. Your group is working well?
2. You have adequate support and training for your facilitator role?
3. You are adequately briefed on course units outside your particular specialism?
4. You have evidence that learning has occurred?
5. You have assessed students fairly?
6. You are clear and in agreement with other facilitators about -
   - the purpose of the portfolio?
   - the content of the portfolio?
7. You have given help when asked?
8. Your students are happy with you?
9. Your students are motivated?
10. Your students are achieving?
11. Your students are cohesive?
12. Your students have adequate access to adequate course material?
13. Your students are learning and integrating skills?



n = 6 (85.7% sample)

Laboratory Work at School and University

R.G. Gabb, Lincoln College, Canterbury, N.Z.
A.H. Mander, Papanui High School, Christchurch, N.Z.

ABSTRACT

In this study, we asked students at both secondary school and university about their perception of the aims of laboratory work in their science courses. To do this, we developed a questionnaire, based on several published lists of aims, which required the students to rate the relative importance of twenty aims of laboratory work for a given subject. Both school students and undergraduates gave relatively high ratings to aims associated with handling data and relatively low ratings to aims associated with learning theoretical concepts and report-writing. The undergraduates gave a higher rating to the illustration of theoretical material than did school students while the school students gave a higher rating to aims associated with the development of the skills of experimentation. We believe that these findings have some implications for the design of laboratory programmes in the early years of undergraduate courses.

Roger Gabb, B.V.Sc., Ph.D.(Syd.), M.Ed.(Bath) is Director of the Educational Services Unit of Lincoln College. His current interests are science and education and course evaluation.

Tony Mander, B.Sc., Dip.Ed.(Cant.) is Head of Science at Papanui High School. He spent 1981 as a Visiting Teaching Fellow at Lincoln College and participated in this study during that year.

Address for Correspondence: Dr. R. Gabb, Director, Educational Services Unit, Lincoln College Canterbury, New Zealand.

INTRODUCTION

Most university science teachers regard laboratory work as not only a 'good thing' for students, but also as an essential component of any good science course. Hundreds of hours are devoted to laboratory work in most science courses and there is a substantial commitment of facilities, equipment and staff to support it. However, despite its costly nature and its almost universal use in science courses, there has been relatively little scrutiny of the effectiveness of laboratory work as a teaching method until recently. The recent growth of interest in laboratory work probably reflects, at least in part, the growing concern of many university administrators with the cost-effectiveness of this relatively expensive method of teaching. It is becoming increasingly necessary for science teachers to justify their continued use of laboratory work and to demonstrate that they use it effectively and efficiently.

However, despite this increase in interest in the cost-effectiveness of laboratory teaching, there are still relatively few published studies of the effectiveness of laboratory work in terms of learning outcomes. No doubt this is due in part to the difficulty many teachers experience in explicating what they expect students to gain from laboratory work. It is also difficult to design sound procedures for the assessment of what are often quite complex outcomes. One approach to the explication of outcomes problem is to work with teachers and help them define the aims and objectives of existing laboratory programmes. In general, in our experience and that of others (e.g. Ogborn, 1977),most teachers find this a difficult task. Another approach to discovering the aims of existing laboratory programmes is to ask the students what they think the aims of various laboratory programmes are. As Boud (1973) has shown, student perception of the aims of laboratory work is not always congruent with the avowed aims of the course designer. This method is not, therefore, the most reliable means of inferring what the aims of the designer of the course were. On the other hand, it is an appropriate means for establishing how students perceive their laboratory work and knowledge of this perception is valuable in itself as it is likely to reflect how students direct their efforts in a given course.

Black and Ogborn (1979) claim that three clusters of aims are suggested in much of the published work on laboratory work:

1. Training in techniques
2. Learning the ideas of the subject
3. Learning how to carry out experimental enquiries

Training in techniques can be defined in a narrow sense as training in manipulative skills such as the use of a pH meter or counting of blood cells. However, it becomes a much broader area if both observational and mental skills are included. Learning the ideas of the subject is often associated with the illustration or verification of ideas which have already been introduced in lectures. However, it may also include work intended to demonstrate the limitations of a theory in explaining real phenomena. Learning how to carry out experimental enquiries suggests an emphasis on the process of science rather than its content. Laboratory work in this area often has a degree of open-endedness in that it attempts to simulate some aspects of scientific research.

In our opinion, each of these clusters represents a valid use of the laboratory for learning science. The real problem in designing a laboratory programme lies in deciding the priority to be given to each cluster and in designing laboratory activities which will facilitate the achievement of these aims.

In this study, we set out to investigate student perception of the aims of several laboratory programmes. We had three main objectives in collecting this data:

1. to provide those responsible for running these courses with some information on how students see the aims of these courses and to stimulate discussion on the aims of laboratory work.

2. to investigate whether students at different academic levels perceived different emphasis in the aims of laboratory work.

3. to investigate whether there were substantial differences between subjects in the perceived aims of laboratory work.

In this report, we wish to concentrate mainly on the second of these objectives, that of examining differences in emphasis in the perceived aims of laboratory work at different academic levels. Although the main focus of the study was on undergraduate laboratory work, we also took advantage of an opportunity to survey some seventh-form (final year of secondary school) students who were studying biology and chemistry in four Christchurch schools. This allowed us to extend our study to the investigation of differences between student perception of laboratory work in the final year of school with that in the first two years of university.

METHOD

Development of the questionnaire

A list of 20 aims of laboratory work was drawn up based on published questionnaires and lists of aims (Kerr, 1964; Chambers, 1966; Boud, 1973; Gould, 1978). This list of aims was designed to be comprehensive enough to include the important aims of most laboratory work and flexible enough to allow its use in all major science subject areas. The list of aims was then developed into a questionnaire by the addition of a preamble and a key which asked respondents to rate each aim according to its importance in the existing laboratory programme of the subject under consideration. The following key was used:

KEY: 4 - an essential aim
3 - a major aim
2 - a minor aim
1 - not an aim
0 - no opinion

The questionnaire was then pilot-tested by administration to a small sample of university teachers and undergraduates. The final 20 aims included in the questionnaire (Table 1) included modifications made after this procedure. The item names in Table 1 are used to identify individual aims in the remainder of this report.

The setting

The questionnaires were administered to students in the first and second years of the four-year Bachelor of Agricultural Science course at Lincoln College, New Zealand. In some cases, the questionnaires were also completed by students of Horticultural Science who were attending the same lectures and laboratories and no attempt has been made to separate these students out. In the first year of the Agricultural Science degree, students were required to take five subjects - Zoology, Chemistry, Environmental Biophysics, Plant Science I and Economics. The questionnaire was administered for all subjects except Economics. In the second year of the course, the subjects studied were Biochemistry, Microbiology and Entomology, Animal Physiology, Plant Science II, Biometrics, Engineering, Soil Science I and Animal Science. The questionnaire was administered for all subjects except Biometrics.

Table 1: List of laboratory aims included in questionnaire

	Aim	Item Name
1.	To allow the student to observe and/or handle actual material	Actual
2.	To help the student develop basic physical skills (e.g. dissection, soldering)	Physical Skill
3.	To train the student in appropriate measurement techniques	Measure
4.	To train the student in the accurate and systematic recording of laboratory data	Record
5.	To train the student in the use of standard laboratory equipment	Equipment
6.	To develop the student's ability to design experiments	Design
7.	To develop the student's skill in problem solving	Problem
8.	To develop the student's ability to assess the validity of his/her experimental results (e.g. assessment of errors and assumptions)	Validity
9.	To train the student in processing raw data (e.g. drawing up tables and graphs, simple computation, statistics)	Data Process
10.	To train the student in interpretation of experimental results	Interpret
11.	To train the student in drawing conclusions consistent with the data	Conclude
12.	To train the student in writing scientific papers	Writing
13.	To illustrate material taught in lectures	Illustrate
14.	To teach some theoretical material not included in lectures	Theory
15.	To provide a stimulus for the student to acquire further knowledge from texts, references, etc.	Texts
16.	To stimulate and/or maintain student interest in the subject	Interest
17.	To communicate some of the flavour of research work	Flavour
18.	To provide the student with a stimulus for independent thinking	Independent
19.	To provide an opportunity for informal discussion between students and staff	Discuss
20.	To provide an opportunity for co-operative work with fellow students	Co-operate

The school students represented a sample of all students studying seventh form biology and/or chemistry at four Christchurch schools. Although these students comprised an opportunity sample, the four schools appear to represent an adequate cross-section of Christchurch state secondary schools.

Procedure

The questionnaire was administered to undergraduates during the last week of lectures for each subject and was administered in a scheduled lecture or laboratory period. The instrument was administered to all school students in the third term of their academic year. The school students completed the questionnaires during a chemistry or biology class under the supervision of their usual teacher. Because the questionnaire was originally developed for use with university students it does contain reference to lectures, a form of teaching not much used in schools. An alternative interpretation of these items was suggested to the students at administration to make it more relevant to their situation.

RESULTS

In analysing the data, it was assumed that the response key was interpreted as an interval scale and descriptive statistics were calculated on this basis. Responses of 'O' (no opinion) were excluded from the analysis.

Comparison between school and university

In order to allow an across-the-board comparison of the relative rating given to aims by school students and university students, Table 2 lists the mean rating assigned by the students for each aim.

Table 2: Rank orders of ratings of laboratory aims by school and university students

School			University		
Rank order	Aim	Mean (s.d.)	Rank Order	Aim	Mean (s.d.)
1	Interpret	3.1(0.7)	1	Actual	3.2(0.9)
2	Actual	2.9(0.8)	2	Illustrate	2.9(0.8)
	Conclude	2.8(0.8)	3	Interpret	2.8(0.9)
3	Record	2.8(0.8)		Conclude	2.6(0.9)
	Validity	2.8(0.8)	4	Physical Skill	2.6(1.0)
6	Equipment	2.7(0.8)		Record	2.6(0.9)
	Illustrate	2.6(0.9)		Validity	2.6(0.9)
7	Interest	2.6(1.0)	8	Equipment	2.5(0.9)
	Physical Skill	2.6(0.9)		Measure	2.5(1.0)
	Data Process	2.5(0.8)	10	Data Process	2.4(0.9)
10	Independent	2.5(0.9)	11	Interest	2.2(0.9)
	Measure	2.5(0.8)		Co-operate	2.1(0.9)
	Problem	2.5(0.9)	12	Independent	2.1(0.9)
14	Co-operate	2.3(0.9)		Problem	2.1(1.0)
	Design	2.3(0.9)		Theory	2.1(0.9)
16	Texts	2.2(0.9)	16	Discuss	2.0(0.9)
17	Flavour	2.1(0.9)	17	Texts	1.9(0.9)
	Theory	2.1(0.9)		Writing	1.9(1.0)
19	Discuss	2.0(1.0)	19	Flavour	1.8(0.8)
20	Writing	1.7(0.9)	20	Design	1.6(0.8)

The values recorded here are the means of consolidated ratings across 6 school/subject groups and across 12 undergraduate subject groups. While this mean is based on a large number of observations (up to 258 for school students and 1006 for university students), it should be remembered that it represents multiple responses from a smaller number of individual students (approx. 150 school students and 200 undergraduates).

The aims are listed in Table 2 in rank order for both groups. Both groups gave high ratings to aims associated with real material (Actual) and handling data (Interpret, Conclude, Record, Validity) while giving low ratings to aims associated with learning theoretical concepts (Texts, Theory). Both groups also rated report-writing as a minor aim of laboratory work (Writing). However, there were also some marked differences in the two groups. The use of laboratory work to illustrate the content of lectures (Illustrate) was ranked seventh by school students and second by undergraduates. There was also a difference in the rating given to the development of the skills of experimental design (Design) where school students ranked it fourteenth and undergraduates ranked it twentieth.

Comparison between years of university course

Four of the university subjects surveyed were first-year subjects and the other eight were second-year subjects. Table 3 shows the mean rating for first and second-year subjects and includes the rating for school subjects for comparison. In general, the students apparently did not see any marked change in emphasis between first and second-year laboratory programmes. They did, however, tend to rate aims associated with basic manipulative techniques (Physical Skill, Equipment) as being less emphasised in second-year courses. They also indicated that report-writing (Writing) was stressed more in second-year courses than first-year courses.

Table 3: Ratings of laboratory aims by school, first-year university and second-year university students
(mean with standard deviation in parenthesis)

Aim	Schools	First-year university	Second-year university
Actual	2.9 (0.8)	3.3 (0.7)	3.1 (0.9)
Physical Skill	2.6 (0.9)	3.0 (0.8)	2.4 (1.0)
Measure	2.5 (0.8)	2.6 (0.9)	2.4 (1.0)
Record	2.8 (0.8)	2.8 (0.8)	2.5 (1.0)
Equipment	2.7 (0.8)	2.7 (0.8)	2.4 (1.0)
Design	2.3 (0.9)	1.6 (0.8)	1.6 (0.8)
Problem	2.5 (0.9)	2.3 (1.0)	2.0 (1.0)
Validity	2.8 (0.8)	2.6 (0.9)	2.6 (1.0)
Data Process	2.5 (0.8)	2.5 (0.8)	2.4 (1.0)
Interpret	3.1 (0.7)	2.8 (0.8)	2.8 (1.0)
Conclude	2.8 (0.8)	2.6 (0.9)	2.6 (1.0)
Writing	1.7 (0.9)	1.7 (0.9)	2.0 (1.1)
Illustrate	2.6 (0.9)	3.0 (0.8)	2.9 (0.8)
Theory	2.1 (0.9)	2.1 (0.8)	2.1 (0.9)
Texts	2.2 (0.9)	2.0 (0.8)	1.9 (0.9)
Interest	2.6 (1.0)	2.3 (0.9)	2.2 (1.0)
Flavour	2.1 (0.8)	1.8 (0.8)	1.9 (0.9)
Independent	2.5 (0.9)	2.2 (0.9)	2.0 (0.9)
Discuss	2.0 (1.0)	2.1 (0.9)	2.0 (0.9)
Co-operate	2.3 (0.9)	2.1 (0.9)	2.1 (0.9)

Comparison between subjects

Mean ratings for different subjects suggest some variation in the type of laboratory work used in these subjects. For example, there appears to be a different rating profile for physical science subjects and biological science subjects in that physical science laboratory programmes tend to be seen by the students as emphasising manipulative skills (Measure, Equipment). In general, also, the students tended to rate the development of problem-solving skills (Problem) at a higher level for physical science laboratory programmes than for biological science. On the other hand, laboratory programmes in biological science were seen as emphasising the illustration of lectured material (Illustrate).

DISCUSSION

The aims in the questionnaire fall into three main categories which are related to the three clusters of aims described by Black and Ogborn (1979). The first category includes aims associated with the physical skills of conducting an experiment (Physical Skill, Measure, Equipment) and is similar to Black and Ogborn's Cluster 1 - Training in techniques. The second category includes aims which are concerned with the ideas of the subject and attitudes to the subject (Actual, Illustrate, Theory, Texts, Interest, Flavour, Independent, Discuss, Co-operate) and is related to Cluster 2 - Learning the ideas of the subject. The final category is concerned with the intellectual skills of investigation (Record, Design, Problem, Validity, Data Process, Interpret, Conclude, Writing) and is related to Cluster 3 - Learning how to carry out experimental enquiries.

The undergraduates surveyed saw some of the aims in Cluster 2 as emphasised in their courses (Actual, Illustrate). They also rated some aims associated with training in techniques highly (Cluster 1 - Physical Skill, Equipment, Measure). However, when it came to aims associated with experimental investigation (Cluster 3), they rated aims associated with the handling of data as important (Interpret, Conclude, Validity) but perceived aims associated with designing experiments as being minor aims at best (Design, Problem). This conclusion was reinforced by a preliminary analysis of the laboratory manuals used for these courses which, without exception, contained exercises involving step-by-step instructions aimed at directing the student towards a pre-determined result - a 'cookbook' approach.

The pattern of response from school students suggests that some schools, at least, adopt a somewhat different approach. The school students rated some Cluster 2 aims (Learning the ideas of the subject) as being of lesser importance than university students did (Illustrate, Actual) while giving a higher rating to some Cluster 2 aims (Learning how to carry out experimental enquiries) than the university students did (Problem, Design).

Pella (1961) described six idealised stages in a scientific investigation. They are:

1. a statement of the problem
2. the formulation of an hypothesis
3. the development of a working plan
4. the performance of the activity
5. the gathering of data
6. the formulation of conclusions

As the undergraduates saw it, the exercises in their laboratory programmes emphasised the last three stages. On the other hand, there was apparently some emphasis on the first three stages in the secondary school programmes. This is confirmed by a study of the seventh-form Biology syllabus, where approximately one third of the school year is spent in project work which is designed by the students. The public examinations which are set for these students reflect this strong emphasis on investigative skills.

Many of these students no doubt went on to university courses similar to those reported here and it is interesting to speculate on their reaction to this transition from a laboratory programme at school which includes some enquiry-oriented exercises to one at university which omits this component. No doubt most students take this transition in their stride, but the change in emphasis probably leads to the atrophy of some of the enquiry skills which they started to develop at school. Ironically, it is sometimes the teaching staff who are responsible for this atrophy who are most vocal in their condemnation of the investigative ineptitude of final-year students!

The students from both school and university saw the development of report-writing skills as being of little importance in nearly all laboratory programmes. A recent survey of practising scientists in Australia (Dunn, Kennedy & Boud 1980) indicated that they felt that the skills which require greater emphasis in undergraduate science courses were:

* written communication
* drawing conclusions from results
* scientific report writing

The conjunction of this find with the apparent lack of emphasis on written communication in these laboratory programmes is a matter for some concern. The low rating given to this aim by the university students in the present survey may be a reflection of something we detected in many of the laboratory manuals we examined - many manuals included short-answer questions for reporting results rather than requiring comprehensive reports.

As we have stated before, we believe that all three clusters of aims are important in their own right. We believe that it is important for students to learn the techniques which are basic to each subject (Cluster 1) and we do not wish to underate aims which are concerned with illustrating ideas which have been introduced in lectures (Cluster 2). There is no doubt in our minds that aims such as this are valid and important. However, we do wish to suggest that enquiry-oriented aims (Cluster 3) are also important if we wish to nuture the investigative skills which the students start to develop in their final years at school.

At present, according to our survey, laboratory programmes in the first two years of the Bachelor of Agricultural Science course appear to emphasise the illustrative aims of laboratory work at the expense of investigative aims. We believe that it would be appropriate to introduce some enquiry-based exercises into these programmes so that investigative skills are developed for the project work which is a feature of some senior undergraduate courses. At the same time, we also believe that the skills of written communication should receive more emphasis in these laboratory programmes.

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A Pragmatic Evaluation of Practical Teaching in Science—The Method

Hugh B. Guthrie
The Flinders University of South Australia

ABSTRACT

The method used to evaluate first year practical teaching in science at the Flinders University of South Australia is described. The method is based on Parlett and Hamilton's "illuminative approach" (Parlett and Hamilton 1972). An evaluation model is presented which recognises three "phases" in a programme of practical teaching:

(i) the inputs - which relate to the characteristics of the learning environment affecting course planning and administration
(ii) the process - that is, the description of the actual experience of teaching and learning and;
(iii) the outcomes - that is, the actual achievements of the programme of practical work.

The evaluation reported has concentrated on inputs and process of the Biology I course at Flinders and the present paper briefly describes the information sources used to evaluate these phases. In addition the advantages and potential difficulties of the evaluation model adopted are discussed.

Hugh B. Guthrie, B.Sc.(Education), M.Sc.(Melb.), M.Ed.(Bath) is currently a Research Fellow in the School of Biological Sciences, The Flinders University of South Austrlia. He was previously a Demonstrator in Biology at Flinders University and has been interested in both educational evaluation and the problems of practical teaching in science for some time.

He is soon to take up an appointment as Education Research Officer at the Royal Melbourne Institute of Technology.

Address for Correspondence: Dr. H. Guthrie, Education Unit,R.M.I.T., P.O. Box 2476V, G.P.O. Melbourne 3001 Victoria.

INTRODUCTION

Practical work is generally assumed to be an essential component of any good science course (Anderson 1968). Indeed, Finegold and Hartley (1972) maintain that laboratory work is an accepted and integral part of undergraduate education in science. Soper (1962) considers that there is a widely held view, which he claims needs vigorous rebuttal, that the time spent in the laboratory is quite unnecessary.

Despite the belief in the "necessity" of practical work, criticism of it as a teaching technique has been extensive and often vigorous (for example, Chambers 1966) and there are a growing number of science educators who seriously question the need for it and its effectiveness. Moreover practical teaching is a costly educational technique, not only in terms of the contact time committed, but also in terms of the physical resources consumed. Yet, as Hofstein and Lunetta (1980) argue: "the effort and expense involved in laboratory teaching may be justified if it can be shown that such teaching is uniquely successful in achieving important educational objectives."

The literature on laboratory work is extensive. Much of it is concerned with describing the practical programmes in use at particular institutions, or with innovations in the methodology of laboratory instruction (for examples in tertiary education see Boud et al. 1978). However all too often there appears to have been little, if any, serious attempt to evaluate existing programmes of laboratory instruction or, indeed, new innovations in practical teaching.

The present paper aims to describe an initiative in the evaluation of practical teaching in science by the School of Biological Sciences at The Flinders University of South Australia. The paper deals with the context in which the evaluation arose, the aims of the evaluation, its methods and the advantages and potential problems of the chosen evaluation method now apparent after the project has been in operation for one year.

THE CONTEXT

The background to the evaluation

Throughout the late 1970's there was a growing concern amongst many members of academic staff in Biological Sciences over declining pass rates both in Biology I and other first year science subjects. Indeed, pass rates in the Biology I course had declined from 45% [6] in 1975 to 30% [7] in 1980. Similar trends were noted in the Physics and Chemistry disciplines. It was postulated that these declining pass rates may have been due to:

i) changes in the method of calculating aggregate scores in the South Australian matriculation examination which inflated the scores awarded in science subjects and which possibly meant students had an unrealistic and inflated view of their theoretical preparation for tertiary studies and/or;
ii) a declining standard in the academic quality of students enrolling at Flinders and/or;
iii) a shift in the socio-economic background of first enrolling students at Flinders and a change in attitudes to, and motivation for, tertiary studies.

It was acknowledged that the science schools should react positively to these declining pass rates rather than accepting them as the inevitable consequence of circumstances which were beyond the direct control of the University. An intensive evaluation of first year teaching methods in science therefore appeared appropriate. Since practical work at Flinders is seen as a necessary, important - and expensive - method of teaching, it was decided to develop a method for evaluating first year practical teaching in science. Accordingly, the T.E.C. was approached to fund the evaluation. The proposed project was rejected, however the Flinders University subsequently decided to fund the project using savings from the outside studies programme.

The aims of the evaluation

I was engaged as a Research Fellow to conduct the evaluation of practical teaching. The project was funded for two years. The objectives of the evaluation were threefold:

i) To evaluate practical teaching in science at Flinders University by:

a) the production of a detailed list of aims and objectives of practical teaching which could then be used as a basis for evaluating practical teaching and planning programmes of practical work.

b) the development or adaptation of questionnaires and simple techniques to help evaluate various aspects of the teaching programme.

c) the inspection and analysis of relevant course materials and other school or university documents related to practical teaching.

d) the collection of data on the time committed by students and both demonstrating and technical staff to preparing for, executing and completing individual practical exercises.

e) the collection, review and dissemination of relevent evaluation instruments for practical teaching developed elsewhere.

f) the collection, review and dissemination of relevent literature on practical teaching.

g) the trial of evaluation materials developed in the study in the School of Physical Sciences at Flinders University to determine their applicability to other science disciplines.

ii) To improve the effectiveness of practical teaching in the School of Biological Sciences and in other schools or disciplines within the University where the materials are used.

iii) To improve the efficiency of practical teaching in the School of Biological Sciences and in other schools or disciplines within the University where the materials are used.

The school evaluated

For several reasons I concentrated my initial attention on the School of Biological Sciences. Firstly, I had previously taught in this school and know its staff very well; I also had an excellent grasp of the school's social and political milieux. Secondly, I was well acquainted with the school's general teaching aims and methods. I felt, too, that I could concentrate on developing evaluation techniques and strategies best in an environment I knew well. Indeed, my previous experience in the school not only helped me to establish evaluator credibility fairly rapidly, but also helped me to interpret much of the information subsequently collected. Finally, since Biological Sciences had initiated the evaluation I felt that they should derive the greatest benefit from its findings.

The course evaluated

Biological Sciences runs two courses at first year level, Biology I (which is designed mainly for science students) and Perspectives in Biology, which is offered exclusively to students enrolled in non-science desciplines. Student numbers in both courses vary from year to year, however 154 and 104 students initially enrolled in Biology I and Perspectives respectively in 1981. Neither course claims to require matriculation (or HSC) biology as a pre-requisite for entry. However, approximately 67% and 96% of the 1981 intake in Biology I and Perspectives respectively had studied biology at year 12 level.

The evaluation concentrated on the Biology I course which, in 1981, comprised 78 1-hour lectures and 21 3-hour practical classes involving 20 individual practical

exercises. This course was chosen because I had been largely responsible for developing the practical component of the Perspectives course and therefore could have had difficulty conducting an "objective" evaluation. Secondly the Biology I course has not undergone significant change for some years. In 1982 the instruments and methods developed during the evaluation of Biology I are being trialed in the Chemistry Discipline of the School of Physical Sciences at Flinders.

THE METHOD

The Philosophy

The evaluation is based on the social-anthropological research methodology proposed by Parlett and Hamilton (1972) and draws on the approach to evaluating tertiary courses used by the Advisory Centre for University Education (ACUE) at Adelaide University (Hall 1977, 1979). The evaluation is described in the title to this paper as "pragmatic". It is a pragmatic evaluation because it not only aims to provide feedback to its major audience quickly and continuously, but also is intended to be a useful rather than an elegant and sophisticated piece of research.

This evaluation essentually serves three audiences:

i) the staff, the principal audience, who are involved with planning and implementing the course;

ii) the course participants, that is, the students and;

iii) interested outsiders (the university administration, other schools within the university, other institutions and individuals).

Clearly the interests of all these groups in the findings of the evaluation potentially conflict. Thus, the present evaluation has aimed to concentrate on information gathering rather than decision making, and has sought to identify, investigate and report important and significant issues in the complex reality which makes up the Biology I programme.

The Model

A model of the evaluative process adopted is presented in Figure 1. Any academic course is seen to have 3 basic and related components: inputs, process and outcomes. "Inputs" relate to the characteristics of the learning environment which affect course planning and administration (for example staff teaching abilities and interest, student preparation, motivation and attitude, the physical resources available in the department etc.) Evaluation of the input component should therefore reveal the constraints imposed on the course by the staff, the students, the course, departmental and university administrations and the physical resources available. "Process" involves the implementation of the planned course and is concerned with the actual experiences of teaching and learning, for example the course content, the teaching and assessment methods and the laboratory milieu. Finally, the course outcomes reflect the actual achievements of the learning process. These three components are included within the framework of the stated aims and objectives of the course (Figure 1).

In the model, each component of the course is evaluated by gathering information, analysing it and, from this analysis, identifying the strengths and weaknesses of that course component. The analysed information is then fed back to staff as quickly as possible either verbally or as a written report. In addition the analysis may reveal a number of potential issues worthy of further investigation. Thus, the model is flexible and can react to issues and situations which may arise and develop during the evaluation. Finally the analysis may yield a number of potential questions which contribute to a pool of potential issues to be explored in an end-of-course questionnaire (Figure 1).

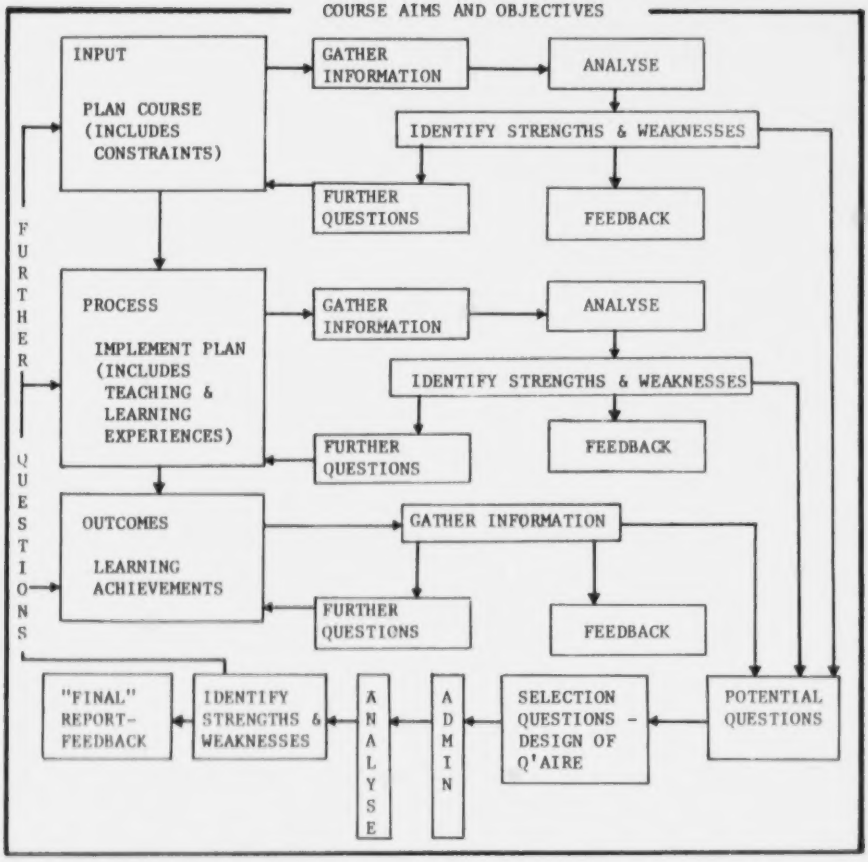

Figure 1. A model for the evaluation of a practical course.

From Figure 1 it is apparent that the evaluation of product has not involved extensive collection and analysis of information. This reflects my intention to concentrate on course inputs and process, areas which have often been neglected in previous evaluations of practical work.

The final component of the evaluation involves the development of a questionnaire administered to all course participants just before, or soon after, the conclusion of the course. From the pool of questions developed throughout the evaluation, questions relating to the important issues which arose during the evaluation are identified and selected. The questionnaire is then developed, trialed, administered and analysed. From this analysis strengths and weaknesses of the programme can be identified. This information is then combined with information obtained (and possibly reported) earlier in the study and fed back to the evaluation's audiences. Thus the evaluation model provides for feedback at regular intervals throughout the evaluation as well as the traditional comprehensive report at its conclusion. The analysis can also yield further questions which may be worthy of subsequent research. Indeed, information collected in the final questionnaire for Biology I in 1981 clearly showed that many students perceived a heavier workload demand in Biology I than their other first year subjects. This problem is currently being investigated.

The evaluation model was discussed generally within the school prior to its implementation. In particular the co-ordinator of Biology I was involved during the development of the evaluation model and the selection of those aspects of the practical course to be evaluated in detail. He was also kept informed during the subsequent development of the questionnaires and other instruments used during the study. I now intend to discuss those aspects of the course which were evaluated.

The evaluation

The determination of course aims and objectives.

A list of course aims and objectives was prepared as a basis for judging whether the "intents" of the course were matched by the planning decisions made about the practical course, its content and its chosen teaching methods. The aims and objectives were prepared by inspection of course materials and by interviewing all members of academic staff teaching the course. Students were also asked for their perceptions of the course objectives in a series of group discussions and in the end-of-course questionnaire. I also refered to published lists of aims and objectives for practical work. From these sources a list of course aims and objectives was prepared. Staff comment on this list was sought. Staff have also been encouraged to prepare and discuss the objectives of individual practical exercises.

The evaluation of inputs.

While there are many factors affecting course planning and administration, I decided to investigate only 2 aspects of "input" in detail. First, very little was known about the problems technical staff encountered in mounting each individual practical class. To investigate this problem I developed a checklist which was completed on a weekly basis by the laboratory technician for the course. For each practical exercise this checklist explored:

i) the problems in both obtaining and using the equipment designated for the exercise

ii) the problems associated with gathering, preparing and using the biological materials for the exercise

iii) the time taken and the number of staff required to set up and clean up the laboratory class.

iv) any problems in liason with academic or other technical staff.

Secondly, very little was known about the amount and type of practical work students had done before enrolling in the Biology I course. Moreover, little was known about the amount of experience students had in performing certain tasks characteristic of practical work in general - and biology in particular (for example little was known about the students' previous experience in producing written laboratory reports or setting up and using compound microscopes). This information clearly has implications for the way the practical course is designed. A questionnaire of 67 items was therefore developed and administered to the 1981 enrolements of both Perspectives in Biology and Biology I. In addition the questionnaire asked students to indicate the degree of confidence they had in performing each of the tasks and skills specified.

Additional information on "input" was obtained from informal discussion with school staff, students and by inspection of appropriate departmental documents.

The evaluation of process

Information on "process" was gathered from a number of sources both on a regular weekly basis and periodically, that is, at times when the information was available or appeared relevant. Information on each individual practical exercise was gathered on a regular basis. A student feedback sheet for practical work used at the University of Surrey (Bridge 1975) was adapted for use at Flinders. This sheet explored the students' perceptions of the difficulty of the practical, their interest in the practical, its relevance to lecture material, the usefulness of the laboratory notes

provided and the quality and availability of demonstrating staff. Data were also collected on the time spent in the laboratory class and afterwards (if appropriate) to complete their laboratory work. An opportunity for free response was also provided.

During each exercise the sheet was distributed to a sample of between 25 and 40 students. Students were asked to complete a feedback sheet on a fairly regular basis, approximately once every four exercises. While this procedure is not methodologically sound, it did ensure that individual students were not unduly overtaxed. Moreover the "groups" of students surveyed changed progressively and no "group" appeared to show any consistent bias in their responses to the individual exercises they evaluated. In addition a form similar to that administered to students was developed for part-time demonstrating staff. For each exercise each of the demonstrators was asked to complete one of these sheets. Their perceptions of the practical were then used both to enhance and to help validate the information obtained from students. Information was also obtained from inspection and analysis of the practical notes provided for the exercise in the course manual, informal observation in the laboratory class and informal discussions with students and academic, technical and part-time demonstrating staff. All the information obtained about an individual exercise was combined and a formal report produced and submitted to the course co-ordinator. At the end of each term the information on individual exercises was consolidated and discussed with the course co-ordinator.

Other information used in the evaluation of "process" was gathered from:

i) consultative groups of students who met periodically with me to discuss issues which related to the practical component of the course as well as other course components (for example the lectures and lecturers, essays, talks, assessment system, workload etc.). These groups were particularly useful in helping to identify and select questions for incorporation in the end-of-course questionnaire.

ii) informal discussions with students

iii) formal interviews and informal discussions with staff

iv) observation and description of the learning milieu in the School of Biological Sciences (Parlett and Hamilton 1972).

v) analysis of the notes for each individual practical exercise to determine the contribution of the practical to the skills and abilities the practical course was aiming to develop.

vi) analysis of the other sections of the course manual (for example, the notes on assessable activities, including laboratory note books, exams, essays, student talks; the lecture schedules for the course and the nominated reference books.). This analysis was the subject of a detailed written report.

The evaluation of outcomes.

The outcomes of the course reflect the actual achievements of the course, not only the extent to which stated aims and objectives are achieved, but also outcomes which were unintended. In student terms outcomes might be measured by gains in knowledge and intellectual abilities, gains in manipulative skills and the development of communication skills. The course may also bring about changes in student attitude and motivation. Many previous studies (for example, Yager et al. 1969) have tried to measure the outcomes of practical work, usually by comparing alternative methodologies. Often, however, these studies have been demonstrated to have serious deficiencies (Shulman and Tamir 1973, Hofstein and Lunetta 1980) and doubts had been expressed about the validity of the instruments used in them to measure some course outcomes. Extraneous factors were also found to be difficult to control. Moreover, the evaluation of other course components already planned in the present evaluation made relatively heavy demands on students. I therefore decided not to institute a programme of pre- and post-course student testing to evaluate outcomes. However, I made informal observations of the level of manipulative skills achieved in practical classes, inspected samples of student work submitted for assessment and held discussions with both staff

and students. This information was documented and fed back at appropriate times.

The end of course questionnaire.

An end-of-course questionnaire of 43 items was prepared and administered approximately 2 weeks before the end of third term 1981 to all students still actively enrolled in the Biology I course. The questionnaire was based on one used by the Office for Research in Academic Methods (ORAM) in a student evaluation of the Biochemistry Department at the Australian National University (Anderson pers. comm.). The present questionnaire explored issues related to all sections of the Biology I course, including course aims and objectives, lectures, practicals, essays, student talks, course assessment and work load.

CONCLUSIONS - The advantages and problems of the chosen technique.

From the preceding account it should be apparent that this evaluation of the Biology I course at Flinders has involved a considerable input of my time and effort. By any measure therefore, it has been expensive and the amount of time involved in maintaining contact with both students and staff and in gathering, processing and reporting the information collected would prevent more than two or three courses of this type being evaluated by an individual evaluator each year. Thus the intensive nature of this evaluation method is its major problem. Paradoxically this problem is one of the major advantages of the technique.

The period and extent of evaluator contact with this course has meant that I have become well known to both staff and students. This enabled me to obtain information which may not be revealed by a less intensive evaluation. In short, I believe I have penetrated the "inner workings" of the course. In addition, the length of contact with staff and students has, I think, served to reduce the threat which evaluation often poses to both groups, particularly the former. Finally the intensive nature of this evaluation has allowed most interest groups in the course to be identified and contribute. In particular students have perceived this evaluation with its independent evaluator as a useful method of providing staff with feedback about the course. However, both staff and students have been exposed to the evaluator for an extended period. Therefore I have had to remain tactful and sensitive to the problems of both groups in order to maintain their trust, and to protect and maintain my sources of information. I have also tried to remain as objective as possible and avoid the temptation to interpret the information collected in a way which favors my own biases and beliefs while ignoring evidence that was counter to those biases and beliefs.

At this stage it is difficult to measure the success of this evaluation. Of course, its success is not necessarily measured by the amount of change effected in the Biology I course. Comprehensive reports and other information have been presented regularly to staff throughout the evaluation. These reports have not only served to inform staff of the strengths and weaknesses of the course, but also have made them more aware of the many complex issues which have to be addressed in planning and running a programme of practical instruction. Hopefully therefore this evaluation has enabled the staff to question the status quo, and to re-examine the present practical course with a more critical eye. On the basis of this re-examination I believe staff will become committed to, and effect, meaningful change in the practical programme.

NOTES

(1) These figures represent the number of students achieving a passing grade expressed as a percentage of the number of students initially enrolled in the course. The balance therefore includes students who actually failed the course or withdrew.

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The Overgrown Lecture Course: A Case for Radical Pruning

L.W. Andresen
University of New South Wales

ABSTRACT

A common pathology affecting lecture courses is the accumulation of too much material for available class time. The author describes aspects of a consultancy in which he worked on the task of trimming down a large body of subject matter to make it fit into unusually severe time constraints. Each stage of the process was based upon a particular area of educational theory. The stages comprised (i) subject unpackaging (Gowin); (ii) concept mapping (Novak); (iii) use of organising themes (Ausubel); (iv) algorithmization (Landa). The resulting streamlined course is demonstrably simpler and more satisfying to teach; evidence is being gathered regarding its effect on student learning. It is believed that the trimming techniques are applicable to a variety of disciplines and of use to lecturers who may be engaged in the appraisal and redesign of their own courses.

Lee Andresen, B.Sc.(Qld), Dip.Ed.(Qld) is an Education Officer in the Tertiary Education Research Centre. He has previously tutored in Sociology of Education at U.N.S.W., being a UNESCO Senior Lecturer in Science Teaching and Curriculum Development at the Universities of Dar es Salaam and the South Pacific, and taught science in Queensland and East African schools. He is presently completing an M.Ed.(Hons.) in Philosophy of Education at U.N.S.W. His current interests include Higher Education teaching methods, educational innovations, course design, information dissemination, staff development, course evaluation and student assessment.

Address for Correspondence: L. Andresen, T.E.R.C., The University of N.S.W., P.O. Box 1, Kensington N.S.W. 2033.

INTRODUCTION AND BACKGROUND

The author was educational consultant to a project which aimed to improve the instruction given to undergraduates on efficient use of the university library. Library classes generally occupy only one hour, occasionally two. The preferred teaching method is lecture presentations, supplemented by visual aids (e.g. overhead projector). Only rarely in classes of longer duration can practical 'hands on' work be given.

A tacit curriculum already existed, after a number of years of development by the senior Reader Education Librarian and his teaching staff. It consisted of the composite of virtually all those elements of knowledge and skill which librarians considered students ought to know. These elements were organised in a linear sequence, in logical consistency with the perspective of practitioners of library science, and informed by a wealth of practical experience of the problems students meet in using library tools.

Whereas there was no particular reason to question the usefulness of the existing curriculum, it was felt that there was room for improvement if only a determined effort were made and if some outside expertise were brought in by engaging an educational consultant. Though initially it was believed that enough improvement would occur through upgrading teaching skills and presentation techniques, on closer examination it became evident that there were problems involving the content of the course.

This account will deal with only one aspect of the project's work, that is how the team went about appraising and reorganising the course content, although a number of other important issues were, of course, dealt with in this project. It will deal with only one outcome of that appraisal and reorganisation, which is its effects on the quantity of material included in each one-hour class. The almost universal experience of librarian-educators had been that in lecturing a group of students for 50 minutes there was never enough time to cover everything, yet no rationale or policy to justify dispensing with any particular bits of the course rather than others.

PROCEDURAL DECISIONS

It was decided, at the start,

(i) to regard the library instruction curriculum as an academic subject in its own right, hence to draw on the sorts of curriculum theory and practice as would be applicable to the more substantive academic disciplines. Library instruction is, of course, much narrower in scope than any major discipline and certainly less conceptually complex. Yet it does share a number of characteristics with other disciplines, namely a vocabulary of specific concepts, a particular methodology or set of procedures, and a commitment to a set of explicit or implicit values.

(ii) to find bodies of theory on which to base course development. From the many theoretical perspectives available in contemporary instructional science, a choice was to be made of a limited number of compatible viewpoints that appeared most likely to help solve the major problems being faced. For dealing with the problem of concepts within the curriculum (the component of knowledge 'that'), cognitive psychology provided theories; for dealing with the problem of operating strategies and procedures (the component of knowledge 'how'), educational technology supplied a theory base.

(iii) to divide responsibility between the disciplinary specialists and the educational consultant (i.e. the librarians and the author) so that any given task would move back and forth between the two parties until a product was obtained that satisfied both. In the event, this approach had the unexpected but welcome result that each learned quite a lot of the other's expertise.

(iv) to expect that this approach, in generating a better curriculum for library instruction, would also provide (a) some evidence one way or the other on the relevance of the theoretical bases as tools for curriculum development, and (b) a model that could be used or adapted by academic staff in the major disciplines for achieving particular curriculum objectives in their own courses.

STRATEGIES ADOPTED

Work proceeded in four stages, each representing a strategy derived from an appropriate theoretical base. A brief account will be given of each in turn, with an illustration of the sort of library materials that were developed, and a brief summary of the theoretical viewpoint that informed the strategy.

Stage I: content unpackaging

This required the detailed specification of the subject matter and the precise clarification of the aims of library educators. The main source of knowledge content is the librarians themselves, who are both its practitioners and exponents. Hence they drafted statements comprising lists of ideas and topics which they thought covered the full scope of the subject matter. These were further compared with similar statements from the literature of library instruction, and yet greater specification was achieved by adding details drawn from analysis of tapes from a number of actual library instruction classes earlier observed.

Next it was decided to adopt Gowin's technique for extracting and analysing the knowledge content of a discipline. This perspective is informed by an important basic assumption, which is that:

> 'When it comes to analysing what is to be taught, no one is better qualified than the scholar in the discipline. It is the scholar who must tell us what is known, and as a consequence, what is to be taught. This assumption is plausible, but it is a half-truth. The scholar in a field is rarely the most likely candidate to provide us with knowledge about knowledge. He is willing to say what he knows, but not to talk about it. His very expertness in establishing specialised knowledge claims prevents him from developing a second-order knowledge which is about these first-order claims.' (Gowin, 1970, p.320)

The version of Gowin's unpackaging technique adopted was that which Novak has presented, viz.

> '...five questions useful in helping teachers to unpack knowledge (are):
> 1. What is (are) the telling questions?
> 2. What are the key concepts?
> 3. What methods of inquiry (procedural commitments) are used?
> 4. What are the major knowledge claims?
> 5. What are the value claims? ' (Novak, 1977, p.142)

These questions were applied to the entire curriculum, section by section. Following is an example to illustrate the sort of outcomes obtained (somewhat abbreviated):

JOURNAL INDEXES

Telling Questions

What are the nature and function of Journal Indexes that make them of use?

Key Concepts

Journal (periodical, serial), Index, Abstract, Subject, Author, Title.

Procedural Commitments

To follow efficient and economical procedures for (i) locating an Index on the library shelves, and (ii) locating literature references within an Index.

Knowledge Claims

Indexes are located in ..... Indexes are used by .....
Indexes are used for ..... Some Index limitations are .....
Examples of Indexes in a particular subject are .....

Value Claims

In performing a literature search, one ought to use a Journal Index because .....

By employing these five questions, a view of the subject matter was obtained which was

substantially different from that which had previously been taken by many of the librarians; a pedagogical perspective rather than a practitioner's perspective. After unpackaging the entire subject in this manner, it became possible to search for general principles, common elements, recurring themes and overarching concepts. These are major characteristics of the subject representing what Novak calls its 'psychological structure', which means those characteristics and relationships which have the potential to make the subject maximally meaningful to the learner.

> 'Most teachers and textbooks proceed in a logical order rather than in a psychological order...a biology course that describes group after group of plants from bacteria to trees, and animals from amoeba to man, may be logically organised, but the important concepts of ecology, genetics, evolution, metabolism and behaviour may be completely buried...one reason successful students continue to be successful is that they have somehow mastered the art of transforming logically presented information into a psychological organisation.' (Novak, 1977, pp.94-96)

Following are important elements of psychological structure unearthed by applying Gowin's unpackaging rules to the subject:

THE KNOWLEDGE AND SKILLS FOR EFFICENT LIBRARY USE
comprise:

1. A group of descriptive ideas that transcend libraries and refer to the general process of scholarly communication.

2. A group of descriptive ideas relating specifically to libraries, and which deal with the processes of searching for information. These can be known as library problem-solving tools.

3. A group of ideas that arise from the application of problem-solving strategies to library searching. They refer to procedures people would be advised to use in library searches, and are prescriptive. They can be known as library problem-solving strategies.

By combining these ideas one is able to construct a verbal statement about the entire subject, at the highest possible level of generality (such a subject statement is of potential use as an organising statement at the start of a course of instruction). One example of such a statement is:

> 'persons intending to break into the scholarly communication network in order to pursue their own particular goals as students ought to choose the most powerful search tools available and follow the strategies recommended by librarians if they are to acquire the information they need, and hence achieve their study goals, in the most efficient and economical manner.'

It is possible to regard the teacher's task, in its most general sense, as being to communicate these principal elements of the subject matter to students as meaningfully as possible. The student who comes to 'know' this particular subject will thus come to:

1. know that (certain concepts about libraries and literature searching)
2. know how (to carry out certain procedures for searching), and
3. to know these things because (certain value claims relating to rationality, efficiency and economy).

The organising framework for the library instruction curriculum was seen to be comprised basically of the abovementioned elements, together with an important distinction between two aspects of searching which had hitherto been confused in our minds and which the unpackaging process unravelled in a short time. These were the distinction between

---

1. How library users find things they want in libraries (books, journals, documents, etc.), and

2. How researchers find things they want in the literature of their subject.

The former we agreed to call 'library searching', and the latter 'literature searching'. This completed the unpackaging process.

Stage II: concept mapping

Concepts were observed to comprise the first key element in the psychological structure of the subject. A theoretical base was needed that would enable the complex web of interlocking concepts to be transformed into a rational design for teaching, and in particular to provide a rationale for choosing to teach some and not others, or some first and others later. An approach based on the work of Ausubel and Gowin seemed ideal for this; the design of conceptual hierarchies or concept maps.

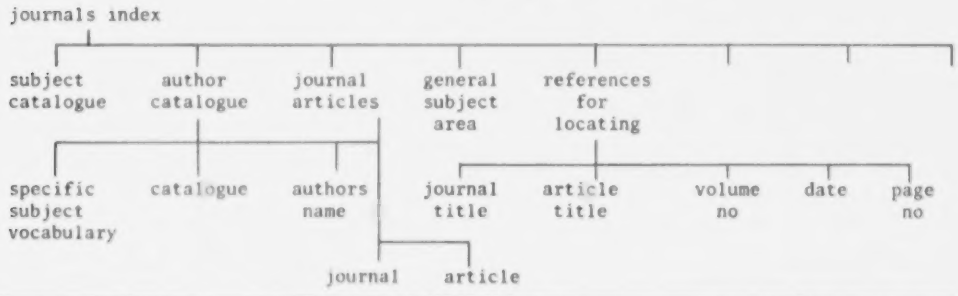
> 'Determination of what in a body of knowledge are the most general, most inclusive concepts, and what are subordinate concepts is not easy...good curriculum design requires an analysis first of the concepts in a field of knowledge and second consideration of some relationships between these concepts that can serve to illustrate which concepts are most general and superordinate and which are more specific and subordinate. One reason school instruction has been so ineffective is that curriculum planners rarely sort out the concepts they hope to teach and even more rarely do they try to search for possible hierarchical relationships among these concepts...'
> (Novak, 1977, pp.86-88)

It was found that concept maps could be constructed along the lines suggeted by Novak. The following guidelines were adopted, partly based on Novak and partly the result of informed guesses and trial and error:

CONSTRUCTION OF A CONCEPT MAP

1. Write the concept down (concept A)
2. Consider another (concept B). Is knowledge of B necessary for understanding A? Can A be defined meaningfully to a learner without assuming prior understanding of B? If knowing B is necessary for understanding A, then class B as subordinate and A as superordinate.
3. Write B under A on the map (or above it if the other answer is given). Proceed in this way with further concepts C, D. etc. until all related concepts are mapped.
4. Draw lines on the map indicating conceptual dependence. Any item on the map linked to (an)other item(s) below it by means of such lines is conceptually dependent on those subordinate items.

SIMPLIFIED CONCEPT MAP FOR JOURNALS INDEX



The immediate role of such a map would be to provide clear, meaningful definitions of key concepts. The rule used here was that any superordinate concept can be defined meaningfully in terms of a sufficient number of subordinate concepts that are (i) themselves already familiar to the learner, and yet (ii) not so subordinate as to be trivial. This generally was found to involve a choice of concepts from the row immediately below the new superordinate concept being defined.

MEANINGFUL DEFINITION OF JOURNALS INDEX
(using subordinate concepts from map)

> A journals index supplies references to locating journal articles within a general subject area: the reader obtains these references by consulting either the subject catalogue or the author catalogue, both of which are contained within the index.

Superordinate concepts were often related (in the row immediately below them) to a relatively large number of subordinate concepts of roughly equal status (that is, all subordinate to about the same degree). It was found that if this first subordinate row is itself arranged laterally in order of salience to the key superordinate concept, this greatly helps decision-making about how much information to present to a class at one time.

This can be illustrated by the journals index hierarchy quoted above. The first subordinate row contains five concepts of greatest salience, but there are a possible six or seven more that can be classified as marginal (and are not included on the map). The distinction between central and marginal was made by applying the following criterion:

> Which subordinate concepts are indispensible if a student is to grasp the essential idea of the key concept? Which, if omitted, would cause the student to have an insufficient grasp of the key concept to be able to apply it at the level required?

This sort of practical distinction played a crucial role in pruning the course. It is a tool for teachers to use in deciding how much information to give about the meaning of a new concept at the point at which it is first being introduced to a class. It then allows the teacher to put more marginal ideas and relationships aside for use later in the course, or if time allows, if students ask questions that require it, or for more advanced students who need it.

Concept mapping, together with the criterion of salience described above, is also of use for teachers who need to know what to say about complex concepts in the early stages of a course and what to leave for later years. This suggests the use of cyclic patterns of concept building, in which concepts are first introduced at a rudimentary level (i.e. defined in terms of a selected number of most salient subordinate ideas) and then progressively 'filled out' in later years by the accretion of more marginal relationships with other concepts.

It seemed appropriate to concentrate on the central features of a new concept early in the class when students are more likely to be fresh and attentive and probably more motivated, and to leave more marginal features of the concept as optional material for later in the class when boredom or tiredness may be setting in, attention is less, and time is running out. Another option for the teacher is, of course, to spend time in class on only the most salient and central ideas of the concept, and to prescribe reading or provide handouts so that students themselves cover the more marginal relationships outside class time. Whichever means is employed, the effect is to reduce the actual quantity of information with which students have to be burdened during the class lecture-presentation without sacrificing meaningfulness. Indeed, if the theoretical base is sound, meaningfulness ought to be enhanced by the pruning process.

It was decided to design concept maps for the main topic areas within library instruction and to make these available as resources to teachers. Teachers may find them to be of use in:

(i) Anticipating which prior knowledge they can reasonably expect students to have at their disposal; this delineates the range of already-familiar ideas to which explicit reference can be made in class to help assimilation into students' thinking.

(ii) Anticipating important relationships between concepts that ought to be brought out in class to facilitate meaningful understanding.

These could be relationships (a) between distant concepts that are analogous in their pattern or structure, (b) between different concepts that have confusing similarities, and (c) between instances of a concept masquerading under the guise of different words.

(iii) Deciding upon the most precise, relevant and meaningful form of definition to employ when first presenting the concept in class.

Stage III: Organising Themes

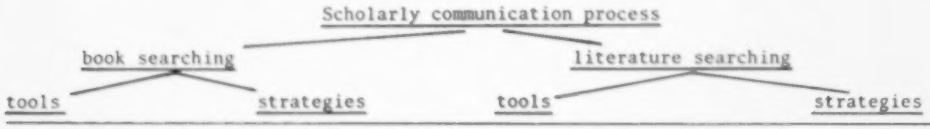
Class presentations in library instruction had hitherto followed the pattern of a linear series of points of exposition. This is a common structure for lectures to assume. Implicit in it are a number of beliefs, such as that (i) a point, once made, does not ever have to be made again (it has been 'done'), (ii) additional points are made in logical sequence, (iii) it is proper to continue making points until all class time is exhausted (class time exists for the purpose of being filled with points), and (iv) other things being equal, the more points that can be included in the time, the better the presentation.

On the other hand, the literature of cognitive psychology suggests that there may be much that students can gain in meaningfulness and comprehension if a rather different structure is imposed on the presentation of information. Among the suggested ways of planning and organising the structure of information in verbal presentations, the thematic approach plays an important role and it was decided to investigate the possibility of using this in library classes.

> 'The main danger in meaningful reception learning is not so much that learners will frankly adopt a rote approach, but rather that they will delude themselves into believing that they have grasped genuine meanings when they have really grasped only vague and confused sets of empty verbalisms... Precise and integrated understandings are, presumably, more likely to develop if...the central unifying ideas of a discipline are learned before more peripheral concepts and information are introduced...Good organisational advantage can be taken of pervasive or recurrent themes that can integrate or interrelate many different topics or general ideas... It is obviously necessary for pervasive themes to be introduced early.... if they are to serve an integrative function.' (Ausubel, et al, 1978, pp.124,372)

Unpackaging had revealed three major bodies of related concepts which seemed ideally suited to use as organising themes in much the same way as evolution, ecology and genetics are able to be used in teaching biology. It had already, quite fortuitously, been observed that one of these themes (scholarly communication) had considerable power for integrating the presentation of a library class, and was effective also in motivating students. Hence it was decided to develop the three themes, taking into account a hierarchical relationship that existed among them:

ORGANISING THEMES



Model presentations were then designed for three levels of instruction (basic, intermediate and advanced) and the potential of the thematic approach was put to the test.

OUTLINE STRUCTURE OF A MODEL CLASS AT BASIC LEVEL

Theme I: Scholarly Communication

Organising statement on the significance of reading lists followed by explanatory statements on how to decode a typical reading list. (10 minutes)

Theme II: Library Problem-Solving Tools (example: catalogues)
Organising statement on the need to have catalogues in libraries, followed by explanatory statements which (i) define the main types of catalogues and indicate their location, (ii) clarify the theoretical principles that catalogues embody, and (iii) present how catalogues operate under ideal conditions. (20 minutes)

Short break for distribution of a concept summary sheet (5 minutes)

Theme III: Library Problem-Solving Strategies (using catalogues)
Organising statement on the rationale for choosing a particular strategy, followed by explanatory statements about (i) things that must be known before starting a search, (ii) the varieties of strategy available, and (iii) what to do when a strategy doesn't work as expected. (20 minutes)

Final break for distribution of a strategy summary (5 minutes)

Library instruction classes at any level of sophistication whatever and for any year group or discipline could hypothetically be built up from these three organising themes at whatever detailed level of elaboration may be appropriate. Ausubelian theory would suggest that the preferred sequence for presentation would be to first present the theme at a high level of abstraction, making explicit reference to familiar ideas already in students' experiences, and to follow this with as many explanatory sequences as may be required, each dealing with one aspect of the new information, returning from time to time to point out the way each new point bears on the general theme.

Stage IV: Algorithmization

Unpackaging highlighted the fact that problem-solving strategies or procedures were a class of knowledge distinct from the concepts that comprise the discipline. A particular pedagogy might be required for presenting these to students; that is, teaching 'how' might require different approaches to teaching 'that'. Time constraints indicated, however, that a number of optimal approaches for teaching strategies, such as by 'hands on' discovery or guided discovery, were simply not practicable. Only one hour is typically available for teaching both the concepts and the procedures for using them.

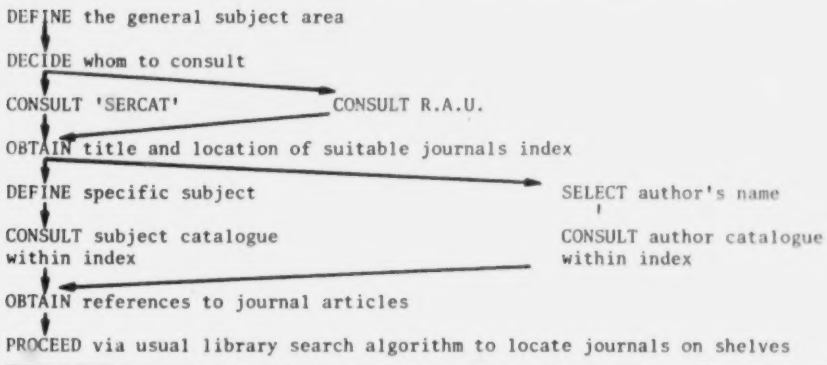
Algorithmic theory provided a useful base for solving this problem. The most elaborated version of this theoretical approach is that of Landa, who prescribes that students ought to be taught 'premeditated algorithms' (that is, procedural strategies designed by the teacher in advance) if specified conditions are met. These conditions are:

1. If the problems are significant and not trivial.
2. If the algorithms are neither too difficult to understand initially or to master with practice.
3. If the problems to be solved by the algorithms are likely to be encountered often enough by students.
4. If it would be harmful for students if their problem-solving were very unproductive or if it led to very erroneous results or took too great a time, in the absence of the premeditated algorithm.
5. If there may exist a class of students, whose interests we would not wish to ignore, who because of the inherent difficulty or complexity of the problem would not be capable of discovering the algorithm for themselves by trial and error within a reasonable time.

(Landa, et al, 1974, pp.132-8)

It was our considered belief that each of these conditions was satisfied in this case, hence we proceeded to design 'premeditated algorithms' for the purpose of offering ready-made strategies in printed form to students in class.

PREMEDITATED SEARCH ALGORITHM: JOURNALS INDEX


DEFINE the general subject area
DECIDE whom to consult
CONSULT 'SERCAT'
CONSULT R.A.U.
OBTAIN title and location of suitable journals index
DEFINE specific subject
SELECT author's name
CONSULT subject catalogue within index
CONSULT author catalogue within index
OBTAIN references to journal articles
PROCEED via usual library search algorithm to locate journals on shelves

In adopting an algorithmic approach, three related issues arise. These are partly because of certain objections teachers may have to the use of algorithms and fears (often based on earlier unsatisfactory experience) that they would not be effective or acceptable to students.

1. Choosing a suitable medium for communicating the algorithm to students. The flow-chart, as used above, is generally recommended as optimal, provided care is taken that students understand how to read the charts. A second alternative is question and answer list-structure, perhaps preferable if students are quite unfamiliar with flow-charts.

2. The problem of simplifying large and complex algorithms. Unwieldy flow-charts are intimidating to users, hence sub-charts are recommended. Each complex procedure is thus broken down into a primary sub-chart (the essential core of the procedure) plus ancillary sub-charts dealing with rarer combinations of events (to be consulted only as circumstances require).

3. Choosing a style of presentation and appropriate graphic design. A wide variety of styles are indicated in the literature, so that users can choose from pictorial, illustrated, top-down, left-right, verbal, branching patterns, box shape varieties, colour discriminations, and so on. Particular student needs will be taken into account in deciding this. We decided on a stimulating illustrated form for first year students so as to enhance appeal and offer motivation.

For subjects where the class presentation is followed by perhaps a number of occasions on which students are engaged in face-to-face contact (in the library or the laboratory) with staff, the premeditated algorithm forms a tangible link between the class and those subsequent teaching opportunities. If, as is commonly the case, class time does not permit students to fully absorb and grasp the algorithm's implications, they will of course take it away and use it as they carry out practical work using the search strategies. This implies that mastery is not the aim of the class presentation; mastery is something that can, however, follow subsequently provided the presentation is meaningful and is assimilated by students.

SUMMARY AND OUTCOMES

It must be acknowledged that none of these techniques of curriculum design necessarily imply that the outcome will be a pruned or streamlined course. Our experience in applying them had, nonetheless, this particular outcome. The content of particular library classes appeared to be reduced by up to perhaps 30% of what it had previously been.

It is of some interest to consider why this outcome should have arisen, and especially whether it was on account of some property of the techniques themselves (and hence generalisable to other disciplines and situations) or merely an artifact of the specific

conditions under which we were operating (and hence not of much interest beyond library instruction). I think there are some reasons why, using hindsight, one ought to expect at least some pruning of deadwood as the outcome of these approaches. Following are some plausible conjectures as to why this might be the case.

1. Unpackaging led us directly to face the distinction between the expert/practitioner's perspective and the learner/user's perspective. When these perspectives do differ, it seems unarguable that the teacher ought to adopt the latter in communicating in class presentations. Putting oneself in the position of the learner, in regard to what prior knowledge might exist and what future knowledge might be relevant, is enormously simplified by working with an unpackaged subject whose component strands can be distinguished and whose key elements identified. In short, unpackaging appears to provide invaluable groundwork for many types of subsequent pruning. Putting, for example, concepts into one box, procedural commitments into another and value claims in a third, a lucidity seems to be achieved which makes it enormously easier to make pruning decisions rationally.

2. Concept mapping itself has the characteristics of a good pruning tool. At the point of deciding upon the relationships between concepts it is appropriate to start making a host of important decisions such as to include one thing but exclude another from the course. Decisions of this sort are able to be made with a clear rationale; in our case it was that centrally important ideas be retained but marginal ideas dropped.

(i) a concept may be too advanced for present needs, hence can be delayed for a later year.
(ii) a concept may be too complex, as conventionally treated, hence can be initially introduced at a very simple level (and in a short time) using a form of definition that can be progressively 'filled out' later using what Ausubel calls progressive differentiation.
(iii) a concept may be unnecessary because it is identical with one already familiar to students, hence it is only necessary to refer back to the familiar one.
(iv) a concept may be relatable to some parallel or analogous one that has been dealt with in earlier work.
(v) a concept may be superfluous because it has no present relevance and no future concepts depend upon it.

3. Organising themes may contribute less directly to cutting down the amount of material in the course, but it was the experience of teachers who planned and presented model classes in library instruction that they privately attributed a role to the thematic approach. It appeared to result in their feeling less pressure to fill the class time with information merely for its own sake, or merely because it was available. This follows because if the teacher is committed to organising the material around an integrating theme, material will be included only if it is clearly relevant to that theme, while any irrelevance that occurs will be evident not only to the teacher but to the students. The effect is to create a sort of public accountability for the lecturer. The obligation to fill the void of one hour with information for its own sake is exchanged for the obligation to speak as meaningfully and relevantly as possible about the particular theme or themes that have been announced. Then, when relevant material is exhausted, the lecturer stops speaking, even if the hour is not yet over.

4. When procedures or strategies are being taught, algorithmization provides at least two avenues for engaging in pruning. First, having realised that the subject matter itself is of a logically sequential decision-tree type, and having decided that it ought to be presented in a premeditated fashion, the question becomes one of a choice of teaching medium. Is a verbal discourse the appropriate medium or will diagrammatic or pictorial methods be more effective? Further, is mastery a realisable aim given the shortness of class time, or is comprehension sufficient, to be followed by mastery later when practical application is possible? Pruning results from the realisation that lecture time previously spent on certain matters can more appropriately be spent on others.

Second, the laborious but instructive process of designing good teaching algorithms gives insights into aspects of the structure of the subject that may have been pre-

viously unrealised. The teacher identifies bodies of information that are, relative to the main task students will most commonly face, merely conditional or contingent in nature and dependent on particular (perhaps unlikely) circumstances applying.

These special contingencies can be dealt with by sub-charting, and class time need not be spent on them. Hence the main algorithm is explained in minimal time and stress is placed on the decision points at which students can be referred to subcharts in the event that they are required. This echoes, in a different guise, the earlier principle of concentrating on essentials and focussing on matters of greatest importance for most students, taking into account the actual needs they are likely to experience and the reasons why they are studying the subject.

CONCLUSIONS

The experience of this work has led the author to conclude that if overcrowding of a lecture course is a problem, comprehensive analysis and redesign along lines such as those that have been described can certainly help solve it. This is not to overlook that there may be many simpler and more direct (though less thorough) ways of pruning a course. However the strategies described above have, in the author's view, the considerable merit of being derived from a theoretical base. Each step taken is then able to be justified by a coherent rationale which ultimately has its defence in some uncontroversial aim such as the enhancement of meaningfulness. This is the case in the present project; when we aimed at making things more meaningful for students, we ended up with a pruned course.

It is believed that the development of improved ways of designing and reconstructing courses would be facilitated if existing theories in, say cognitive psychology and instructional technology were deliberately exploited in this way. By thus being put to the acid test of their relevance to the actual, complex, teaching-learning situation, useful evidence for their soundness may be obtained and, in addition, course development may be put on a better basis than the ad hoc one so often found. The outcome may be better theory as well as improved practice.

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Job-Market Demand for TAFE Secretarial Students: An Evaluation of the School of Secretarial Studies Full-time Courses

Ann Montague
N.S.W. Department of Technical and Further Education

ABSTRACT

An investigation of the success of 2,800 TAFE secretarial students in obtaining relevant employment was carried out in 1981. Seven months after course completion more students from higher ability groups and courses had found relevant employment than students from lower ability groups and courses. All country students had greater difficulty obtaining any employment than metropolitan students. Country students from lower ability groups and courses found it very difficult to find any employment, and nearly one-third were unemployed. Some issues arising from these results are discussed, for example the provision of broad-based courses for a wide range of low-skill occupations, the different employment patterns of highly skilled and below-average operatives.

Ann Montague, B.A. (Wellington, N.Z.), M.Ed. (Waikato, N.Z.), Dip. Ed. Stud. (Waikato, N.Z.), is an Education Officer in the Educational Planning Branch, N.S.W. TAFE.

Address for Correspondence: Ms. A. Montague, Educational Planning Branch, N.S.W. Department of TAFE, Box 5280 G.P.O. Sydney 2001 N.S.W.

INTRODUCTION

TAFE courses are organised into twenty-four teaching schools. Each of the 90 NSW TAFE colleges has a number of schools. Some metropolitan colleges, for example Sydney Technical College, have most schools, whereas small country colleges have as few as two or three. The schools run courses that are uniform across the colleges in which they occur. There is a School of Secretarial Studies in most TAFE colleges. The school runs four one-year, full-time courses and offers many part-time courses. The enrolments for both full-time and part-time courses are high. Although they have remained fairly constant over the last few years (see Table 1), they have declined in proportion to the total TAFE enrolments.

Table 1 Enrolments in the School of Secretarial Studies

Courses \ Students	1976	1977	1978	1979	1980	1981
Full-time Sec. Studies School	6643	6781	7466	6879	7345	7006
Part-time Sec. Studies School	22628	22993	22320	23874	26874	24619
Total TAFE Enrolment	228738	239195	260692	275644	291312	314042
Total Secretarial Studies School as % of total TAFE	13%	12%	11%	11%	12%	10%

The School of Secretarial Studies (located at 21 metropolitan and 68 country colleges) provides many country girls in particular, with their only chance to obtain vocational training in traditional female occupations in their local areas. The full-time courses mainly enrol school leavers. The principal objective of their curricula is to teach skills that are required to obtain secretarial and office employment.

Therefore, the standards of the courses and the relevancy of their content to the work-force can be ascertained by investigating the students' ability to find secretarial or office work and their use of the skills in their employment. Such an investigation would also reveal the relevancy of the courses to specific country areas, as well as the ability of these areas to absorb the numbers of students trained.

The four full-time courses differ in their availability, subjects taught and the type of students who enrol in them. Accounting and Calculating Machines is only available at Sydney Technical College. The Advanced Secretarial Studies Course is available at 20 colleges and is restricted to students who have passed the Higher School Certificate. The Office Training Course is available at 8 colleges and is open to students who have passed the School Certificate. The Secretarial Studies Course is offered at most metropolitan and country colleges and is open to students who have passed the School Certificate.

The Advanced Secretarial Studies course aims at providing Higher School Certificate holders with training in secretarial skills to an advanced level in order to take up employment or improve their employment prospects. The Office Training course aims to provide language-disadvantaged students with office training to enable them to work as typists, clerks or receptionists. The Secretarial Studies course aims at providing students with practical training in the basic skills and (according to the students' ability and inclination) many of the specialist techniques required for office work.

Secretarial Studies students are sub-divided on the basis of entrance tests in English and Mathematics, School Certificate English and Mathematics results, as well as aptitude tests, into a number of ability groups called "Strands". Students with the highest marks are put into Strand 1 and those with the lowest into Strands 5 and 6.

The Strands differ in the subjects the students learn. All students take four core subjects (typing and office skills, individual development, oral communication and business communication). However,students from different strands vary in the electives they study. As Table 2 shows, Strand 1 students learn more subjects and have, as a result, a larger repertoire of skills behind them when applying for jobs than do Strand 5 and 6 students.

Table 2 Electives studied by each Strand of Secretarial Studies Students

Electives \ Strands	Strand 1	Strand 2	Strand 3	Strand 4	Strand 5	Strand 6
Clerical Procedures	*	*	*	*	*	
Machines/Typing	*	*	*	*	*	No
Shorthand	*	*	*			Elec-
Shorthand/Typing	*	*	*			tives
Bookkeeping	*			*		

In 1980 two surveys of 1979 full-time student were carried out. Students from the four full-time School of Secretarial Studies courses as well as all the full-time Certificate courses were questioned on their employment, use of skills learnt at college and intentions to undertake further tertiary study. This paper reports on a similar survey of 1980 School of Secretarial Studies Students, using a revised questionnaire.

METHODOLOGY

Students enrolled in the four full-time courses, and who were still attending classes in the first week of September, 1980 were sent questionnaires in July, 1981. The ex-students were questioned on their employment status on June 30, 1981; their current participation in Tertiary Education and whether they planned further study in the future; their use in their employment of the skills taught; and the length of time taken and efforts made to secure employment. Non-respondents were sent a reminder letter and another copy of the questionnaire 6 weeks later.

RESULTS

A total of 4,152 questionnaires were sent out. Of these, 2,829 were returned and 2,793 were able to be analysed (questionnaires that were incomprehensible, incorrectly answered or returned too late, were excluded). Table 3 shows the response rate for each course.

Table 3 Response rates of students from the four full-time School of Secretarial Studies Courses

Respondents / Course	Questionnaires Sent	Questionnaires Analysed	Response Rate
Advanced Secretarial	571	327	57%
Office Training	322	205	64%
Accounting and Calculating Machines	85	53	62%
Secretarial Studies	3174	2223	70%
TOTAL	4252	2793	67%

Although the response rate (67%) was relatively high for a postal survey, it cannot be assumed that the respondents were fully representative of the student population as a whole. The results, therefore, will be discussed in terms of how these respondents answered, and trends they may indicate for the student population as a whole.

Because the Accounting and Calculating Machines course involved a small number of students, only the results of the three larger courses will be discussed in this paper.

Employment Status

The employment status of the respondents was classified into the following five categories:

- Full-time secretarial/office work - one or more of the skills learnt at college used frequently
- Full-time non-secretarial/office work - none of the skills used
- Unemployed - no regular full-time employment on 30 June 1981 but actively looking for work
- Not in the work force (no regular full-time employment on 30 June 1981 but NOT looking for work)
- Part-time work

Table 4 Employment status of the respondents

Employment Status	Secretarial Studies			Advanced Secretarial			Office Training		
	All Students %	Metropolitan %	Country %	All Students %	Metropolitan %	Country %	All Students %	Metropolitan %	Country %
Office Work	74	89	66	87	92	77	62	85	47
Non-Office Work	8	3	11	4	2	7	12	6	16
Not in Labour Force	2	2	3	3	4	3	4	3	4
Unemployed	16	6	20	6	2	12	22	6	33
Total %	100	100	100	100	100	100	100	100	100
N	2220	697	1523	321	215	106	190	92	98

In all three courses very few respondents (only four) worked part-time. As a result this category was excluded from the analysis. A higher percentage of Advanced Secretarial respondents found secretarial employment than did Secretarial Studies and Office Training respondents (see table 4). In all three courses, a higher proportion of metropolitan than country respondents found secretarial or office work. In some country areas the employment situation was very much worse than in ohers. Some districts, (for example on the North Coast 22% of Secretarial Studies, 22% of Advanced Secretarial and 52% of Office Training respondents were unemployed; Riverina 21% of Secretarial Studies, 11% of Advanced Secretarial and 28% of Office Training respondents were unemployed; and at Broken Hill the only course, Secretarial Studies, had 26% of the respondents unemployed on June 30) did not have sufficient employment opportunities to absorb the numbers being trained. In other areas, for example Orana (Mudgee, Dubbo, Bourke, Coonabarabran area) highly skilled girls had few difficulties as no Advanced Secretarial respondents were unemployed, but 33% of Office Training, 38% of Strand 4 and 44% of Strand 5 Secretarial Studies respondents were unemployed.

Table 5 Employment status of metropolitan and country Secretarial Studies respondents by strand

Respondents / Employment Status	Strand 1		Strand 2		Strand 3		Strand 4		Strand 5	
	Metropolitan %	Country %	Metropolitan %	Country %	Metropolitan %	Country %	Metropolitan %	Country %	Metropolitan %	Country %
Office Work	95	84	91	76	88	74	75	54	84	48
Non-Office Work	0.6	7	4	10	3	8	12	14	4	11
Not in Labour Force	1	1	2	0.7	2	3	0	4	4	5
Unemployed	3	8	4	13	8	15	12	28	8	35
Total %	1100	100	100	100	100	100	100	100	100	100
N	161	304	187	302	193	271	24	417	129	217

When all the Secretarial Studies results are analysed by Strand (Table 5) a similar pattern emerges. In all strands, more metropolitan than country respondents obtained employment. Far more of the better-qualified, more able Strand 1 and 2 respondents found employment than did Strand 4 and 5 respondents.

Early Leaving Respondents

Secretarial Studies courses teach skills that have to be performed at speed (eg typing, shorthand). Much of the time at college, especially in the second half of the year, is spent practising the skills to increase the students' accuracy and speed. It is possible for highly motivated students to achieve speeds in shorthand of 90-100 and typing of 40-50 words-per-minute before the end of the college year. Many of these students did not sit the final examination but left early to take up employment. Hence in the School of Secretarial Studies, some of the best students do not complete the courses. About 25% of all respondents who found employment left either before the final examinations in November, or started work immediately on completing the course.

Job Search

The respondents varied considerably in the ease with which they found employment. Just over 16% of employed respondents made 3-5 applications and secured positions within the first week of looking. This may not have been in December, as many students did not begin looking until late January or February. The largest group (59% of Secretarial Studies and Office Training and 77% of Advanced Secretarial respondents) spent 1-4 weeks looking and made 2-10 applications. Over 25% of respondents from all three courses searched for employment for 5-12 weeks and frequently made a large number of applications. The smallest group (16% of Secretarial Studies, 8% of Advanced Secretarial and 13% of Office Training respondents) took 13-26 weeks to find the positions they held on June 30, 1981.

Unsolicited comments gave an insight into the low morale of many of the respondents who had taken several months to find their jobs, or were still searching in July (7 months after the course had ended) for example, "applied for every job in town", "rang up every office in town".

The unemployed were asked how many positions they had applied for, but the results were of little statistical value for a number of reasons eg many respondents did not answer that question; several gave responses like "hundreds", "everything"; and some answers in numerical terms would at best have been guesses (50, 100) Surprisingly 26% of Advanced Secretarial, 15% of Secretarial Studies and 23% of Office Training unemployed respondents had applied for less than three positions. One wonders if these respondents were seriously looking for employment at all or whether they were being far too selective in the type of positions that they would consider.

As 33% of Advanced Secretarial, 12% of Secretarial Studies and 5% of Office Training respondents who found non-secretarial positions looked for less than one week it would appear that they had no intention of working in secretarial positions. On the other hand, 33% of Secretarial Studies respondents who gained non-secretarial positions had spent 3-6 months job-searching, indicating that they were probably initially after secretarial work but ended up taking anything they could get.

Summary of Employment Related Results

When all the employment related results are compared across all three courses it is apparent that most of the more qualified respondents were able to find suitable secretarial employment. Despite the growth in the use of wordprocessors and workstation equipment, there was still a demand for skilled stenographers and secretaries. The Department of Employment and Youth Affairs estimates (Employment prospects by occupation - 1979, 1980 and 1981) indicate that there has been little change in the number of people employed in stenographic and typing occupations over the last three years (approximately 20,000 skilled workers in Australia in each of the three years). The results of this survey, together with Department of Employment and Youth Affairs estimates, seem to refute earlier predictions of a decrease in demand for all secretarial work (Haworth and Naylor, 1979). There appears to be a strong demand for skilled stenographers and typists but an oversupply of average and below average operatives, especially in country centres.

Students' Use of Modern Office Equipment

It is suggested in the Department of Employment and Youth Affairs publication, "Employment Prospects by Occupations", that there is a need for secretarial training courses to adapt to the inroads made in office work by new electronic equipment. Wordprocessors and workstation equipment in existence now, or being developed, (Data scope February 1982, December 1981) will cause further reduction in routine office work. None of the three courses taught the students to use wordprocessors. However 25% of Advanced and 20% Secretarial Studies respondents had wordprocessors in their offices. Only 5% of Secretarial Studies and 7% of Advanced Secretarial students received 'in office' training and were using them regularly. Although nearly 65% of respondents expressed an interest in learning to use them, there were no TAFE part-time courses in the use of wordprocessors. The students had been taught to use computer-terminals, and nearly 20% of the respondents were using them regularly.

In light of the technological advances that have changed the nature of much everyday office work, there is a real need to include the use of modern office equipment in TAFE's School of Secretarial Studies full-time and part-time courses. This is not easily achieved, however, as the equipment is expensive and quickly outdated. This problem could be solved by colleges leasing equipment such as wordprocessors, electronic filing systems and workstation equipment.

CONCLUSIONS

1. Although the School of Secretarial Studies provided many country girls with their only opportunity to obtain training in traditional female occupations, the local job market in many country areas was not capable of absorbing the numbers being trained. The result was an oversupply, especially of average or below average secretaries and office workers, in some country areas.

2. In contrast, for the most part the employment prospects for highly skilled Secretarial Studies and Advanced Secretarial Studies students were good. Furthermore, some of these students after completing the full-time courses enrolled in part-time TAFE courses to upgrade their qualifications or learn related techniques and skills eg data-processing, intensive advanced shorthand and accounting.

3. Although the Office Training and Strand 4 and 5 Secretarial respondents showed a great deal of versatility in the non-secretarial positions they obtained, it may have been more appropriate for them to have enrolled in a more general "Introduction to the Workforce" course if they did not wish to move from their local area to find employment. This could teach a greater variety of skills that are used in a number of different occupations, rather than spending the large amount of time on a narrow range of subjects that occurs now in Secretarial Studies Strand 5 and Strand 6 classes. On the other hand, it may be that the respondents from these country areas would not have been any more successful at obtaining employment if they had studied such a course, as the difficulty they experienced in finding jobs may have been largely a reflection of the high unemployment rate of young females in their area.

4. It could be argued that for some respondents, the year at a TAFE College did little more than keep them off the unemployment benefit for the year. For many of the unemployed, the extended period with little or no use of the skills, will have resulted in much of what had been learnt at College being lost.

5. It is difficult to ascertain whether completing a course in Secretarial Studies or Office Training did improve the employability of girls who acquired non-secretarial positions. On the other hand, some respondents may have obtained positions, for example as check-out operators, directly as a result of keyboard skills learnt in their Office Training or Secretarial Studies courses.

6. The failure of some vocational course students to obtain relevant employment on completion of their courses is not merely a reflection of the course's effectiveness, but is as much the result of complex, and sometimes unstable, social and economic factors. In this study metropolitan School of Secretarial Studies students found it relatively easy to obtain employment, but many country students who had done the same courses found it very difficult. Hence an evaluation of the efficacy of even vocational courses needs to take into account the effects of pertinant social and economic factors as well as the relevancy of the course to the workforce.

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Survey of 1980 Pre-apprenticeship Students in New South Wales Technical Colleges

Margaret Putt
N.S.W. Department of Technical and Further Education

ABSTRACT

This paper reports on the results of a questionnaire survey of all students enrolled in pre-apprenticeship courses in New South Wales Technical Colleges in 1980. The main aim of the survey was to determine what employment students had obtained subsequent to a pre-apprenticeship course. Other aspects investigated included reasons for enrolling, reasons for withdrawing, the credit that apprentices received from their employer for having passed a course, the number of apprentices who moved away from home in order to obtain an apprenticeship, means of obtaining an apprenticeship, usefulness of the pre-apprenticeship courses, the number of apprenticeships and other jobs applied for, attitudes of employers to the courses, and students' views on the courses. The employment results are also compared with those obtained from surveys of students who had completed pre-apprneticeship courses in the previous three years.

Margaret Putt, B.A.(V.U.W.) is an Education Officer in the Educational Planning Branch of the N.S.W Department of Technical and Further Education.

Address for Correspondence: Ms. M. Putt, Educational Planning Branch, N.S.W. Department of TAFE, Box 5280, G.P.O. Sydney 2001 N.S.W.

INTRODUCTION

Pre-apprenticeship courses are full-time courses, usually of one year's duration, which cover the first two stages of a trade course (mono courses) or stage one of two trade courses (dual courses). Additional practical as well as simulated industrial experience are included in the courses, eg. the building trade pre-apprenticeship students construct houses for the Housing Commission. Students also gain an appreciation of the social and industrial environment and develop communication skills. On completion of their course, students seek an apprenticeship. If successful, they generally enter an apprenticeship with advanced standing and complete the relevant technical college trade course on a day- or block-release system.

The admission requirement for pre-apprenticeship courses is a satisfactory pass in the School Certificate, including a minimum of a grade four pass in English and Mathematics, and a pass in Science. Applicants must be under 20 years of age and may be required to sit for a selection test.

Pre-apprenticeship courses augment the number of skilled tradesmen supplied by the traditional apprenticeship system. The number of apprenticeships offered by employers in a given year depends on the state of the economy. In hard economic times fewer apprentices are taken on so that when the economy improves there is a shortage of skilled tradesmen. The pre-apprenticeship system can reduce this cyclic fluctuation by preparing apprentices in the more difficult economic times.

It was because of an insufficient supply of tradesmen in the building industry that the present type of pre-apprenticeship courses in NSW were begun in the early 1970's. Fluctuating activity in the industry and structural changes such as an increase in sub-contracting meant that the opportunities for apprenticeship training were reduced. Pre-apprenticeship courses have since been introduced in a wide range of trades so that in 1980 there were 30 different courses running in 50 colleges. Total pre-apprenticeship enrolments have increased from 135 in 1971 to 2573 in 1980.

The benefits of pre-apprenticeship courses for students are that they develop basic skills for performing jobs in industry, gain an understanding of work, learn to communicate more effectively, and increase their awareness of the structure of society and of social issues. They can see if they like the trade and if they are suited to it, and they generally have a reduced period of apprenticeship. The courses provide a transition between school and work and prepare students, not only for employment, but for adult life in general.

On the other hand, the employer gains an apprentice with some usable skills and developed attitudes to work. The apprentice requires less time off work to attend technical college and the overall cost of apprenticeship training to the employer is reduced.

BACKGROUND TO THE SURVEY

In October, 1977, a survey was undertaken by the New South Wales Department of Technical and Further Education on behalf of the Commonwealth Department of Employment and Industrial Relations (now Employment and Youth Affairs), and the New South Wales Department of Labour and Industry (now Industrial Relations), to ascertain how many pre-apprenticeship students had received apprenticeship offers. A follow-up survey was carried out the following March to determine how many students were employed. Each successive intake of pre-apprenticeship students has been surveyed about their employment, their opinion of the courses, the amount of credit towards their apprenticeship obtained from their employer, and the attitudes of employers to the courses.

SURVEY OF THE 1980 STUDENTS

Questionnaires were mailed at the end of March, 1981, to all students who enrolled in pre-apprenticeship courses in 1980. A follow-up questionnaire to those who had not yet replied was mailed at the end of May, 1981. The questionnaire consisted of three parts - Form A for those who withdrew from a course during the year, Form B for those who completed a course and who were employed as an apprentice in the week beginning March 30, 1981, and Form C for those who completed a course and who were not employed as an apprentice in the week beginning March 30, 1981. Students were asked to give their employment for the week beginning March 30, so that the results could be compared with those of previous years.

Names and addresses for 2411 students who enrolled in pre-apprenticeship courses in 1980 were available. A total of 1648 surveys were returned completed, with an additional 84 returned "unknown at that address", making a total rate of return of 72%. This was less than the average of 79% for the previous three surveys, possibly partly due to the inclusion in this survey of all those who withdrew from a course.

REASONS FOR WITHDRAWING

Information obtained from colleges showed that 21% of the 1977 pre-apprenticeship enrolment withdrew during the year, compared with 18% of the enrolments in 1978 and 1979. Of the surveys returned by the 1980 students, 350 or 21%, were from those who withdrew from a course during the year. Sixty-five per cent of the 1980 students who withdrew did so because they had obtained an apprenticeship. Three-quarters of these were apprenticed in the same trade as their course. Fifteen per cent left because they had obtained employment but not an apprenticeship, and of these, 40% were employed in the area of their course. Other reasons for leaving, in order of importance, were that they did not like the trade, personal reasons, failed stage one of the course, illness or accident, lack of money, the course was too hard, and because they moved.

REASONS FOR ENROLLING

The students who completed a pre-apprenticeship course were asked to indicate one or more reasons why they had enrolled. Sixty-two per cent of the students said that they had enrolled in order to obtain an apprenticeship in the trade. The importance of this reason was emphasized by the fact that over half of those with a job other than an apprenticeship were still seeking an apprenticeship at the time of the survey. Nearly half of the students said that a reason for enrolling was that they had always been interested in the trade. This was followed, in order of importance, by being unable to obtain employment, to learn useful skills, encouragement from parents, to see if they liked the trade, as a step between school and work, and encouragement from an employer. Other reasons for enrolling included encouragement from a friend or school teacher, to gain experience or qualifications, and not wanting to receive the unemployment benefit.

COMPARISON OF SURVEY RESULTS

The table below shows the employment results for those who completed pre-apprenticeship courses in 1977 through to 1980. For the 1977 students, employment refers to the period between March and June, 1978; for the 1978 students employment refers to the week ending March 31, 1979; for the 1979 students the week ending March 30, 1980; and for the 1980 students, the week beginning March 30, 1981.

Results of four pre-apprenticeship surveys

Student intake / Employment in following year	1977		1978		1979		1980	
	No.	%	No.	%	No.	%	No.	%
Apprenticed	536	57.0	806	59.7	895	64.3	920	70.9
Employed, but not apprenticed	168	17.9	240	17.8	231	16.6	189	14.6
Sub-Total Employed	704	74.9	1046	77.5	1126	80.9	1109	85.5
Full-time student	236	25.1	73	5.4	43	3.1	33	2.5
Unemployed			232	17.2	223	16.0	156	12.0
TOTAL	940	100.0	1351	100.0	1392	100.0	1298	100.0

While there were higher enrolments in 1980 compared with 1979, the total number in the table is less because of the lower rate of surveys returned.

The results for the 1980 students who completed a course show that 71% were apprenticed in the week beginning March 30, 1981. Of these, 92% had an apprenticeship in the same trade as their course. Of the 15% who had employment other than an apprenticeship, 43% were using the training they had obtained from their course. A total of 72% had an apprenticeship or other employment in the same trade as their course. Three per cent of the respondents were full-time students, and 12% were unemployed.

The proportion of students with an apprenticeship has increased each year, from 57% of the 1977 students to 71% of the 1981 students. The proportion of students with employment other than an apprenticeship has declined slightly each year, from 18% of the 1977 students to 15% of the 1981 students. The proportion of students engaged in full-time study programmes has also declined over the years. The proportion of students unemployed has decreased each year, from 17% of the 1978 students to 12% of the 1981 students. In each of the four successive surveys, therefore, there has been an increase in the proportion of students who were employed in March of the year following completion of a pre-apprenticeship course.

If the survey results of the four successive pre-apprenticeship intakes are compared by area, it can be seen that each year the Sydney metropolitan area had the highest proportion of students with an apprenticeship. Newcastle and Wollongong had the next highest proportions while the country (rest of NSW) had the lowest proportion of students with an apprenticeship. A higher proportion of the students in the country than those in Newcastle, Wollongong or Sydney, had employment other than an apprenticeship. The country also had the highest proportion of students unemployed each year.

When the results are looked at by course, it can be seen that each year, at least 75% of the students were apprenticed in the same trade as their course in Automotive Engineering, Baking Trades, Electrical Trades, Fitting and Machining, and Refrigeration Mechanics. The latter course had 100% apprenticed in the trade in each survey. In three of the surveys, over 75% of the students were apprenticed in the trade in Plumbing, and in two surveys, over 75% were apprenticed in the trade in Painting and Decorating and Woodworking Machinery. Courses in which less than 45%

were apprenticed in the trade in each year were Automotive/Welding and Electronics, for three years Floor and Wall Tiling and Panelbeating/Vehicle Painting, and for two years Electrical/Fitting and Machining, Painting and Decorating and Signwriting, and Welding.

USEFULNESS OF THE COURSES

Ninety-two per cent of the apprentices and 45% of those with other jobs said that their pre-apprenticeship course helped them gain employment, while 77% of those without employment found that their course was useful to them. Eighty-two per cent of the students who withdrew from a course and who were employed in the week beginning March 30, 1981, said that their course helped them gain employment.

All students, including those who withdrew from a course, were given the opportunity to make general comments. The most common comment students made was that they found their course good, interesting, worthwhile or enjoyable and that it had given them confidence when applying for jobs.

HELP IN FINDING AN APPRENTICESHIP

Students who completed a course were asked to indicate one or more ways in which they obtained their apprenticeship. For 37% of the apprentices, a direct approach to an employer helped them gain an apprenticeship. Thirty three per cent of the students indicated that the staff at the technical college helped them. A relative or friend was important for 20%, and the Commonwealth Employment Service was of help to 9%. Other ways of finding an apprenticeship included an employer approaching the student or the technical college, the Master Builders' Association, the Job Squad in the Department of Industrial Relations, and work experience programmes.

Those students who were not apprenticed were asked if they would like some help in obtaining an apprenticeship. The name, address, and course completed of those who replied in the affirmative were sent to the Commonwealth Employment Service, the Job Squad, and the relevant employer organisation.

APPRENTICES WHO MOVED AWAY FROM HOME

Thirteen per cent of the apprentices had to move away from home in order to obtain their apprenticeship. Of these, nearly twice as many moved within areas outside Sydney as moved to Sydney. Of the apprentices who moved from one area outside Sydney to another, nearly 30% moved to Newcastle, mostly from the North Coast District. Ten per cent moved to Dubbo, 6% to Wollongong, 6% to Queensland, and the remainder moved to other areas within New South Wales.

CREDIT TOWARDS APPRENTICESHIP

Students who complete a mono pre-appprenticeship course, usually a twelve months' course in one trade, upon gaining an apprenticeship in that trade, enter the third and final year of the relevant technical college trade course. Those who complete a dual pre-apprenticeship course ie. a twelve months' course in two trades, on gaining an apprenticeship in one of the trades, enter the second year of the relevant trade course.

Students who successfully complete a pre-apprenticeship course may also be granted credit towards the relevant apprenticeship by their employer. The period of credit varies according to the particular apprenticeship award and may be open to negotiation. Very few Federal awards prescribe any credits while students who successfully completed the same pre-apprenticeship course, but who are apprenticed under different State awards may receive different amounts of credit. If an

apprentice receives twelve months' credit he enters employment as a second year apprentice on second year rate of pay for twelve months, followed by twelve months on third year rate of pay, and twelve months on fourth year rate of pay.

Of those who passed their course and who were apprenticed in the same trade as their course, 19% did not know how much credit they had received from their employer, and 14% received no credit. The most common amount of credit received was 10-12 months (by 34% of the students), followed by 4-6 months and 13-15 months (by 9% of the students). While students who had passed the same course received different amounts of credit, the most common amount of credit received by students in Commercial Cookery, Plumbing and Vehicle Painting was 4-6 months; in Automotive Engineering, Baking Trades, Butchery, Electrical Trades, Fitting and Machining, Refrigeration Mechanics and Welding it was 10-12 months; in the 36 week Carpentry and Joinery course it was 13-15 months; and in the 54 week Carpentry and Joinery course and in Hairdressing the most common amount of credit received was 16-18 months.

Credit towards their apprenticeship was also obtained by some students who failed their course, and by some who obtained an apprenticeship in a trade outside their course.

NUMBER OF APPRENTICESHIPS AND JOBS APPLIED FOR

Those who were not apprenticed were asked how many apprenticeships they had applied for, and those without any employment were asked how many jobs other than apprenticeships they had applied for. The most common number of both apprenticeships and jobs applied for was between one and five, with successively smaller proportions applying for larger amounts of apprenticeships and jobs. Higher numbers of apprenticeships were applied for than other jobs.

REGISTRATION WITH THE COMMONWEALTH EMPLOYMENT SERVICE

Nearly 20% of the students who were unemployed and who were not in full-time study programmes, were not registered with the Commonwealth Employment Service at the time of the survey. Of those who were full-time students, half were registered with the CES.

ATTITUDES OF EMPLOYERS TO THE COURSES

A smaller proportion of students found that employers were willing to employ students who had completed a pre-apprenticeship course than those who found that employers were aware of the courses. Approximately a third of the students found that all employers they contacted knew about their course, and similar proportions found that most or some employers knew of their course. Four per cent of the students found that none of the employers they contacted knew about their course. On the other hand, only nineteen per cent of the students found all employers they contacted willing to employ pre-apprenticeship students, while 31% found most willing, 37% found some willing, and 7% found no employers willing to employ pre-apprenticeship students.

One reason for some employers being unwilling to employ pre-apprenticeship students, assuming that they were in a position to take on apprentices, was that they thought the pre-apprenticeship students had had insufficient practical experience to justify paying them at higher wages than the school-leaver starting off as a first-year apprentice. One third of the students thought that there was insufficient practical work in their course, and a very common comment in the general comment section was that the students wanted more practical experience on actual jobs, visits to industry, or work experience. Some students also said that employers wanted people with experience and a knowledge of the industry and of working methods.

CONCLUSION

The main findings of the survey are summarised below.

1) Of the students who withdrew from a course, 65% did so because they had obtained an apprenticeship.

2) The most important reason students gave for enrolling in their course was to obtain an apprenticeship in the trade.

3) 71% of the students who completed a course in 1980 were apprenticed in March 1981.

4) The proportion of students with an apprenticeship increased each year from 1978 to 1981.

5) A higher proportion of Sydney students gained an apprenticeship than did students in Newcastle, Wollongong or the country.

6) There was a higher proportion of students unemployed in the country than in Sydney, Newcastle or Wollongong.

7) 83% of the students found their course useful.

8) Students who passed the same course and who were apprenticed in the same trade received different amounts of credit towards their apprenticeship.

9) There are some employers who are unaware of pre-apprenticeship courses and some who are unwilling to employ pre-apprenticeship students.

10) One third of the students said that there was insufficient practical in their course.

These results suggest that in fairness to students, uniform credits off the length of the apprenticeship should be given to all students who successfully completed the same pre-apprenticeship course and who were apprenticed in the same trade. The desirability of some work experience in industry being included in pre-apprenticeship courses is indicated by a) the lack of awareness of pre-apprenticeship courses on the part of some employers, and b) the need to ensure that pre-apprenticeship students' "on the job" competence is comparable to that of apprentices-in-training at an equivalent point in their education. To improve apprenticeship opportunities for country students, it is recommended that pre-apprenticeship courses in, for example, Automotive Engineering, be rotated among colleges having this facility. In this way, different towns would have the opportunity to provide the majority of students and to absorb graduates rather than the same towns continuing to provide the bulk of the student body but not being able to offer subsequent employment.

Although the outcomes for students could be improved as indicated above, it is clear from the four surveys that the pre-apprenticeship programme has been successful in that each year a majority of the students undertaking it have obtained an apprenticeship. In addition, the surveys have shown that each year the proportion of students gaining apprenticeships has increased.

Chapter 3:

TEACHING AND LEARNING DEVELOPMENTS

Enhancing the quality of teaching and learning has always been a major concern of HERDSA and the papers in this section report on a wide variety of approaches to this topic.

Pearson examines some of the justifications commonly advanced to support the individualisation of instruction and develops an analytic framework around the extent to which students can control key areas of course design. Mathematics courses often assume more knowledge than students possess; Taffe considers the extent of this gap and suggests ways in which it might be reduced or closed. Variations in the knowledge possessed by students when they begin a course are also the focus of the work reported by Logan and Bailey which adopts a number of techniques for dealing with the effects of multiculturalism in the teaching of Physics. The potency of project work in enriching student learning is well illustrated by Wellington's account of staff-student collaboration in an engineering design exercise which involved learning in communication and organisational skills as well as technical knowledge.

The significance of the ways in which students perceive, and subsequently respond to, their learning environment is being increasingly recognised by researchers. Feletti, Clarke and Engel discuss some of the problems involved it the interpretation of these perceptions if they are to be used to guide reviews of curricula. Another source of information on how students view their learning experiences is the reflections of graduates. Powell reviews research into the enduring effects of higher education and examines some of its implication for the curriculum and methods of teaching.

Individualisation: Problems and Potential

Margot Pearson
N.S.W. Department of Technical and Further Education

ABSTRACT

Individualised instruction has been advocated for many reasons such as improving student access to education and emphasising learning instead of teaching. In this paper certain features of individualised instruction which are often seen as significant such as self-pacing, the use of media and the claim to be learner centred are examined and rejected as a basis for any systematic analysis of the field.

Instead a framework for analysis of types of individualised instruction is presented which identifies four key areas in which there can be varying degrees of teacher or student control. Implications for the potential of individualisation are then discussed.

Margot Pearson, M.A.(Auckland), Ed.S.(Michigan) is in the Teaching and Learning Unit, Curriculum Services Division, N.S.W. TAFE. She was formerly a member of the Tertiary Education Research Centre, UNSW. She has written articles on various aspects of teaching and learning, and is currently interested in the process of curriculum design.

Address for Correspondence: Ms. M. Pearson, Teaching and Learning Unit, N.S.W. Department of TAFE, Box K638, Haymarket 2000 N.S.W.

What is Individualised Instruction and what is its potential? Individualised Instruction has been advocated for many reasons such as reducing the cost of education, improving student access and putting the emphasis on learning rather than teaching. There are problems however in assessing the claims of proponents and evaluating the record, not the least being the diversity of individualised instruction programmes available. Confusion as to terminology, differences in the underlying educational philosophies and the psychological bases of various approaches as well as differences in education goals makes this diversity a barrier to systematic analysis and evaluation.

In this paper certain features of Individualised Instruction, often seen as significant, such as self-pacing, the use of media and the claim to be learner centred are examined and rejected as the basis of any analysis of the field. Instead it is argued that any individualised instruction approach is most usefully analysed according to how it is organised to structure instruction, to present instruction, to assess student learning and to manage the learning environment. The distinguishing feature between one approach and another is the degree of teacher or student control in each of the four key areas of organisation. From this basis an attempt is made to define Individualised Instruction and to tentatively assess its potential.

The first impression to be gained from the literature as a newcomer to the field, is the apparent certainty of many educational writers and the confusion of terms and strategies available. For Individualised Instruction appears to be an umbrella term that refers to a family of strategies not a strategy.

Furthermore, if we look at some types of Individualised Instruction commonly listed, we can see differences in kind, purpose and presumably outcomes. For example:

. PI (Programmed Instruction) LAP (Learning Activity Packages)	(are the means or resources (for Individualised Instruction
. CMI (Computer Managed Instruction and Contracting)	(are ways to manage the delivery (of Individualised Instruction
. PSI, IPI	(are coherent systems/programmes (of Individualised Instruction

Such confusion is compounded by the proliferation of terms, some with changing meanings. For example: A 'module' can be indistinguishable from a LAP; PI as a product may be a tape/slide set or a text, but as a process is a systematic approach to curriculum development and looks like an aspect of educational technology.

In technical and further education a term that is used in particularly confusing way is 'module'. A module is usually taken to mean a self-contained unit of study that a student can work on alone or with minimum supervision. It is therefore short and built around one or two objectives (Goldschmid and Goldschmid 1973). When a subject or course is broken into a series of modules which students can progress through we have 'modular instruction'.

However in the Victorian TAFE report (AAAC 1975) we have a different use of the term 'module'. The modules are seen as much longer and more complex units of work. Here in N.S.W. TAFE a 'module' can in fact be a semester length unit. This is similar to the use of 'modular' by Quinn (1978) who argues for a change in the U.K. education system to modularisation on the American pattern where subjects are discrete units of 12-14 weeks comprising a course.

In other words we have 'modules' which are the building blocks of a subject and modules which are differently organised subject length units forming a course. In the first instance we have Individualised Instruction. In the second it is possible to have traditional teaching within the long module.

This sort of confusion arises in part from the historical development of Individualised Instruction. In the 1960's individualisation usually referred to a student-paced individual study of prescribed material which was usually common to all students in a course. Hence the common identification of PI with "self-pacing". However, variations soon abounded, as different approaches were developed at different

times, focussed on different instructional problems and addressed different student needs.

A further source of confusion is the use of the same words with different meanings by proponents of different approaches to education. The best example of this is the use of the word 'independent'. Independent learning can mean a student works alone or it can mean that students direct their own learning and study. Many "self-paced" programmes promote independent learning in the first sense only. Other programmes to encourage independence in the latter sense have moved towards student-directed learning which can involve a range of teaching/learning strategies from field study to attending lectures.

Underlying the different meaning of the word 'independent' is a difference in goals. Is the aim to transit a body of information or a set of skills as efficiently as possible? Or is the aim to develop the learner's capacity to learn? These questions are related to the question of who controls the learning process, teacher or student. Adult educators particularly are interested in involving students in making decisions about how their courses are run to meet their needs.

The growing interest in the adult learner as participator in course design and in the learning process is paralleled by a shift in emphasis, interest and concern of many educational psychologists. Much of the early work in Individualised Instruction derived from behavioural psychology. Cognitive psychologists stress the active nature of learning and memory. Glaser (1977) says:

> "Learning and memory is now seen as an integrative process in which there is an active, constructive interaction with events that are encountered in the world. As an individual learns, there is a continual evolution of the structures of knowledge stored in one's memory, and the nature of these structures affects the way in which new information is acquired. Individuals build up different conceptual structures as a result of their different experience, and hence they can be expected to bring their knowledges to bear upon new learning in different ways."

This view of the learner as an active processor of information who interacts with and modifies the stimuli for learning had led to greater research interest in mathmagenic behaviour and in the development of the skills of "learning how to learn". The emphasis is shifting to how the student interacts with materials rather than how information and ideas are presented.

This leads us to a final source of great confusion - the lack of context in reporting. Too often in the literature individualised approaches are discussed without the writer making it clear as to whether the innovation is taking place within the constraints of a lesson in a classroom, or whether changes are being made and of what kind to usual patterns of attendance and classroom organisation. It is not always clear whether an individualised kit of some sort is being used as part of a traditional lesson sequence or is replacing that lesson sequence. In the literature now coming out on CAI, as with previous audio-visual kits, the learning environment and the total classroom delivery system are often ill-defined or not explained at all.

Despite the confusion just described, there are certain features of Individualised Instruction that are seen as common and/or of significance. In particular self-pacing and student centred learning are both seen as characteristic of individualised instruction. The use of the media is also often used as a basis for distinguishing one form of individualised instruction from another - a tape/slide presentation is compared with that using a film or a book and so on. These three features of individualised instruction will now be examined to show the difficulties with using such features of Individualised Instruction as the basis for analysis.

SELF-PACING

Many of the early individualised instruction programmes began with the idea that learners were different as regards rate of learning. From this arose programmes to

allow students to work at their own pace. Even now it is this aspect of Individualised Instruction that has gripped people's attention, so much so that self-paced learning is often referred to as a teaching method in its own right.

The recent Williams Report (1979) advocated that a National Centre for Research and Development in TAFE be established and that it engage on various projects including "The development of self-paced learning programmes".

Of course it was this aspect of individualisation that was most visible. Instead of a large group of students with a teacher out front, students studied on their own and it was assumed at their own pace. From this change other changes were assumed to follow. The slow student would now be able to take longer to study what the fast student would do in less time than before. Neither would be bored or frustrated, motivation would be enhanced and so would achievement as the students learn to manage their own learning. On the basis of these expectations programmes can be distinguished as to how far they permit self-pacing.

Both research and the experience of individualisation has tempered early enthusiasm. The whole issue of self-pacing is now seen to be more complex. For a start, when students are faced with a rigidly prescriptive programmed text they may be working alone but to say the students are pacing their work is misleading. The overall pace has been determined by the programmed developer who decided the size of the learning steps and the graduations according to difficulty (Hartley 1974).

Some forms of Individualised Instruction never in fact tried to give the students complete control over the pace at which they worked through a course. In the audio-tutorial system it is usual to set up the laboratory for a week or two for one unit and the students pace themselves within that constraint. The logistics involved in using organic materials and having parallel small group tutorials demand such limitations. In any system of Individualised Instruction that provides for group activities, there must be some limitations on self-pacing. Similarly, a study of Open University students revealed that students paced themselves around their assignments so that they were engaged in teacher-directed self study (Aspden 1977).

Research into PSI where students do control pacing within a course or subject suggests that self-pacing is not essential to the successful operation of PSI courses and that teacher-pacing as in the audio-tutorial system can be introduced without affecting achievement negatively (Robin 1976). The reason for wanting to introduce some element of teacher direction is of course because of the problem of procrastination and withdrawal in PSI courses. It has been argued that these features of student behaviour are no more characteristic of PSI students than of students in traditional classes. However the expectation was that self-pacing would eliminate such problems.

It turns out that the relationship of time to achievement is not a simple one. Self-pacing alone does not necessarily result in the brighter finishing sooner and the slow getting there in the end. In aptitude-treatment studies researchers have examined the relationship between aptitude and achievement for individualised methods, allowing variable time available and requiring mastery, and for conventional methods. The results do not support the mastery model predictions that aptitude-achievement correlations will be lower for such individualised methods. In meta-analysis of PI, PSI, CAI and the audio-tutorial approach the effect on the aptitude-achievement correlation was very small at best (Kulik et. al. 1979a, 1979b, 1980a, 1980b). Kulik et. al. (1979) conclude that:

> "Individualised Instruction, in which students are free to vary the time and manner of learning, does not seem to narrow the gap between gifted and disadvantaged learners".

Recent studies on time and its use in schools establishes that what a learner is doing in the time available is more important than the amount of time available. The successful children are those who spend more "time on task" (Levin et. al. 1980). Such students have self management skills. The record of Individualised Instruction indicates that the ability to manage ones time effectively is not an outcome of individualised instruction but a prerequisite.

Furthermore, evidence suggests that not all students prefer working alone (self-study) or certainly not all the time. Some topics such as those which involve human interaction will by their very nature demand group work. These considerations have led to many individualised systems providing for peer and teacher-student interaction in small group work. In distance teaching, where the dominant mode of presenting instruction is in self-instructional units, efforts are made to overcome the lack of contact and isolation with study weeks, and tutorials (Morriss 1977).

What then can be said about self-pacing? It turns out not to be the crucial feature of Individualised Instruction after all. Rather we are looking at various forms of individual student study that involve varying degrees and types of teacher and student direction. This individual study may be a minor or major part of the way a course is organised.

LEARNER CENTREDNESS

Another claim often made for types of Individualised Instruction is that they are learner centred in contrast to traditional large group instruction which is seen to be teacher centred. It is not always clear what this means but presumably the claim refers to the rationale for Individualised Instruction that it starts with the learner and adapts instruction to the learner rather than presenting instruction and expecting the learner to accommodate.

One way in which we know that learners vary is in learning styles and preferences. Do individualised study units accommodate these differences? From the research on learning styles it would seem that designing instruction to suit different styles raises problems.

First, there are so many models of learning styles available. The report to the AAAC (1975) refers to styles that range on two continuums, concrete-symbolic and structured-unstructured. Witkin (1977) identified students who are field dependents and field independents. Hudson developed the notion of students as convergers or divergers (Hudson 1966). Pask (Daniel 1977) has developed programmes for serialists and holists (see Cross 1976 for a summary on the subject). The problem for the teacher is that although each model makes sense and there is clearly some overlap, we do not have a working theory of how students learn, which can integrate all the different models of learning styles with learning theories (such as behaviourism, information processing, cognitive psychology) and learning strategies to guide practice.

A more basic objection to designing instruction for different learning styles and strategies is that there is evidence that learning style preferences change from task to task. Hunt (1977) gives as an example, teaching statistics by a programmed text. A student whose previous experience of maths or statistics has been characterised by failure "may prefer to learn in a highly structured setting where he is given continuous positive reinforcement from each response he makes". But another student may find these same characteristics "restrictive and boring". Such students may need an unstructured environment with little overt help where they are presented with a clearly defined challenge to find a solution to a problem.

Laurillard (1979) supports this idea that student learning styles and strategies are context dependent and gives as factors influencing choice of strategies and styles of execution, the students orientation towards the task and their perception of the task itself. Similarly studies of the interaction of students' personality and PI show that the learning milieu, that is the perceived difficulty or not of the task, interact with anxiety and intelligence (Dallos 1976).

Such evidence advises caution in depending on many of the supposed "laws of learning" derived from programmed instruction where instruction was broken down into small steps, the learning hierarchy theory of Gagne that advocated sequencing materials accounting to a hierarchy of pre-requisite skills; and the systems approach to curriculum development where sequencing a prescriptive learning path seems a logical step once the objectives were established.

There is no evidence that any method of sequencing is always superior. Hartley (1974) looked at three different approaches to sequencing - chaining developed by Gilbert, learner control advocated by Mager and the hierarchical sequences advocated by Gagne. He states that research results fail to indicate superiority to chaining, support learner control but not clearly and are also inconclusive in respect to Gagne's hierarchies. A recent meta-analytic review of learning hierarchies research concludes that they have a small effect on learning in secondary school and college students (Horan and Lynn, 1980). It seems that there is no one sequence or structure that is 'correct' but rather different possibilities.

We can however conclude that where instructional units, texts or packages are tightly constructed and sequenced they may restrict the students learning as the style and strategy chosen by the teacher is probably the one that suits her personally - not necessarily all the students. Moreover, the more tightly constructed the materials or packages, the less room there is for students to modify and adapt activities and materials to suit their preferred approach.

Prescriptive individualised instruction may in fact be seen as more teacher-centred than traditional approaches. Dressel and Thompson (1973) warn that "If individualisation is always accompanied by detailed task specification it may actually deny an individual even the degree of independence implicit in the anonymity of the traditional class".

This loss of independence for a student may arise too where courses are reduced to essential components that must be mastered. In many traditional courses 'coverage' means that the teacher talked about or referred to so much subject matter but the student usually learnt a great deal less. In most individualised instruction programmes the student is going to learn all that is presented so that the teacher decides in advance what is essential and puts only that in the units. Boud et. al. (1975) estimates that a PSI presentation covers a third less than a traditional presentation of the same subject. The advantage of this is that now the student learns more thoroughly what is important. The disadvantage is that the student may have less choice than in a traditional course as to what he learns. This is why some teachers try to get around this by structuring the course with core and optional units (Cohen and D'Iverno 1977).

If we turn to students personal and vocational needs we confront a similar situation. Adult students come to courses for varying reasons to meet individual personal and vocational needs. Where courses are structured round prescribed objectives, especially those that are very detailed behavioural objectives, the student has little or no input into the aims and scope of the course, which is unlikely to be structured so as to meet all their individual needs. It is to accommodate this variation of student needs that various types of student directed courses have been established (e.g. Cornwall, 1976, Knowles 1975). Such approaches recognise that individual students may need an opportunity to have input into the organisation of instruction as well as its presentation.

From this discussion we can conclude that whether a mode of Individualised Instruction is learner centred or not depends on how the particular individualised variant is organised and presented. To move from large group lectures to self-study of some sort does not of itself ensure that instruction is learner centred.

MEDIA USE

Types of Individualised Instruction are sometimes distinguished from one another and from traditional teacher directed large group instruction by focussing on the media used. In the 1960's it was an awareness of the potential of technology in education that fueled some of the expectations for revolutionary, and cost-cutting innovation. The use of media was seen of itself as innovatory and much early research was about the effectiveness of one median over another; for example, film versus tape-slide and so on. There is recognition now that the media used is of minor importance when comparing types of Individualised Instruction - Romiszowski (1978) concludes that evidence suggests that variations of effectiveness can be put

down to the intrinsic quality of a product (film, book) rather than to the general characteristics of a medium and how it matches learner characteristics.

In recent years, despite past experience, the rising prominence of one type of medium has led to the re-emergence of a "media-based" approach to Individualised Instruction. The medium is of course the computer. The glamour and the visibility of the computer is so great that CAI is most often referred to as a teaching/learning strategy in its own right. Moreover, just as once it was thought that putting information on a teaching machine, or lecturing via a television screen was innovatory now the same assumptions are being made about the use of computers.

Fortunately some educators and developers have a more sophisticated view. Perhaps because CAI has been used as a research tool for studying learning, some researchers and developers have been more aware of the assumptions and implicit teaching-learning models underlying different uses of the CAI. This is in contrast to much of the writing of LAPs, PI and other individualised instruction programmes that was often distressingly superficial.

Howe (1978) sees PI and CAI where they concentrate on drill and practice as based on a model of teaching that is still "talk/chalk and question/answer" - the difference is only in the medium. Looking at application of CAI with micro-processors, Howe with Boulay (1979) sees each programme as located on a dimension that ranges from 'learning by being told' to 'learning by discovery'. They see drill and practice as an abuse of the potential of educational technology. Romiszowski (1978) categorises applications of CAI differently depending on the degree of prescription involved.

The significant feature about these reviews of CAI is that the medium is not seen to produce of itself a different teaching/learning model. Whether the students are using CAI, or kits, packages, tape/slide sets or written assignments in class, nothing very different in terms of the relationship between the teacher and the student <u>needs</u> to have taken place. What happens will depend on how CAI is used for instruction. To distinguish variants of Individualised Instruction according to the medium used is to miss the point.

Furthermore, such a concentration on the media used ignores the evidence already referred to for the significance of the learning environment. We need to focus not just on the computer and the software but how that is then integrated into the total course presentation and organisation.

A FRAMEWORK FOR ANALYSING INDIVIDUALISED INSTRUCTION

This wander through the confusions of Individualised Instruction brings us back to the question - what is Individualised Instruction as distinct from traditional instruction, and what distinguishes one variant of Individualised Instruction from another?

From the discussions so far we can see that Individualised Instruction can vary a great deal but that whether a variant is self-paced, or learner centred or based on a particular medium is not useful in answering such questions. Self-pacing, degrees of prescription, types of media are not distinguishing features, or criteria but <u>options</u> open to developers of Individualised Instruction.

How then to systematically analyse the vast array of individualised systems, materials and the host of other variations such as contract teaching, mastery and so on. I will now present an attempt to provide a framework that would enable us to distinguish between different variants and evaluate effectiveness.

If we begin with the decisions that a teacher would have to make in setting up any instructional programme, then four key areas for decision-making can be identified. These are:

A - how to organise (structure the instruction)

B - how to present the instruction

C - how to assess student learning

D - how to manage the learning environment.

Within each of these areas there are a number of related decisions to be made:

A - How to organise the instruction

. Selecting the aims and objectives.
. Structuring the whole into parts (or deciding not to do so).
. Sequencing the instruction.

B - How to present instruction

. Selecting media.
. Selecting teaching/learning strategies.

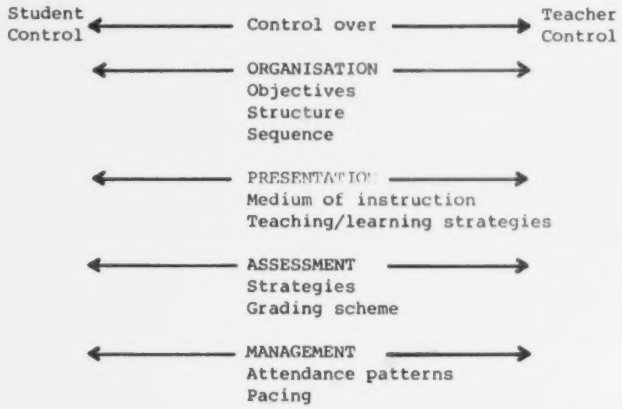
C - How to assess students learning

. Designing assessment strategies.
. Determining grading schemes.

D - How to manage the teaching/learning environment

. Determining attendance patterns.
. Determining the pace.

What then determines how one variant of individualised instruction differs from another will depend on the degree of teacher/student control in these four decision areas. A way to summarize this is as follows:



What we have is a continuum in each of the four areas from complete student control to complete teacher control. In any instructional system the teacher and the individual student may have varying degrees of control in each of these four areas.

The advantage of such a framework is that it allows us to see varying degrees of teacher and student control as options and to be aware of the range of combinations possible. Various systems of Individualised Instruction can be analysed within this framework to identify the salient features of a particular system. Strategies such as contracts which are used in Individualised Instruction but which do not always form a total instructional system can be analysed as providing options in one of the key decision areas.

INDIVIDUALISED INSTRUCTION - A DEFINITION

But what about the first question - how to distinguish individualised instruction from traditional instruction? The foregoing framework will clearly include variants that do not look very different from traditional instruction. The answer may lie in the evidence of research into Individualised Instruction.

Research into Individualised Instruction has many inherent problems such as the lack of definition already discussed, the probable inappropriateness of research design based on group measurements and lack of attention to the learning environment. Much of the research in early years was of the "innovation versus traditional method" design that produced few significant results one way or the other.

However there have been attempts to put together the sounder research studies and review the result; particularly Kulik et. al. have conducted a series of meta-analyses to this end. The interesting result of such studies is that although overall Individualised Instruction can be shown to work as well as traditional methods and sometimes as in PSI produce better results, it is not clear that it is the individualisation per se that produces the improvement.

In studies where the teacher variable has been controlled by having the same teacher present instruction to the control and experimental groups the difference between the effect of using conventional or individualised approaches was smaller. Kulik et. al. (1980a) suggest a possible explanation for this:

> "It seems possible that involvement of teachers in innovative approaches to instruction may have a general effect on the quality of their teaching. Outlining objectives, constructing lessons, and preparing evaluation materials (requirements in both computer-based and personalised instruction) may help teachers do a good job in their conventional teaching assignments".

The differences between experimental and control groups was also less in those disciplines thought of as the hard sciences. It could be that subjects which are less clear cut benefit more from the application of good teaching practices associated with individualising instruction.

In a recent large scale (840 students) study of traditional and PSI approaches to teaching college calculus, an effort was made to present traditional instruction of high quality. Thompson (1980) suggests that it is this that accounts for two approaches producing indistinguishable results in mathematics achievements.

It may be that it is the introduction of structured learning with an improved quality of teaching, rather than the individualising as such, that is the crucial innovation. Such a distinction is a fine one but important. It would suggest that we look towards improving instruction by emphasizing the clarification of the aims, needs and appropriate responsibilities and roles of the teacher and learner in any programme. Individualising of part or all of any such programme would follow as appropriate to meet individual learner needs. Such individualising could involve students carrying out individual assignments, studying a component of a course by working through a computer programme, or carrying out an individual project outside the classroom.

It could, where large blocks of class time are involved, be similar to effective primary school teaching practice where large group, small group and individual study alternate during the day. At the tertiary level, different approaches may be developed to combine individual study with tutorials and sometimes lectures.

Of course this all sounds like many existing programmes, traditional ones in art faculties and innovatory ones such as the audio-tutorial approach in science faculties.

So back to the question - what is individualised instruction? As this point I would conclude that individualised instruction as a method or instruction system ought not to be the focus of attention. Rather we should be looking at something called "individualising instruction" which involves using various forms of individual

study by students as a component of instructional systems designed to meet the needs of individual students.

THE POTENTIAL OF INDIVIDUALISING INSTRUCTION

There is one more aspect of individualised study that I would like to introduce at this late stage. The focus so far in this paper has been on individualising to improve teaching and learning by addressing individual learner needs. Student needs can be, as well as learning needs, needs related to access to courses and institutions. Not all students can attend institutions on conventional patterns of attendance. One expectation of individualising instruction was that it would allow more flexible conditions which would open access to education, particularly for adults. Of course it is for these sorts of reasons that correspondence courses have been established. Correspondence or distance teaching is an area of growing interest, especially since the success of the open university in U.K. What is of interest for this discussion is that distance educators are looking to improve the effectiveness of distance teaching by organising tutorials, study weekends, etc. If we were to see more of these efforts to expand the range of teaching strategies for distance education and at the same time see more individualising of the components of traditional programmes of study, we would be looking at something very similar. I would therefore contend that such an convergence of approaches in distance teaching and in traditional college-based courses to produce flexible alternative instructional programmes for adult learners is where the greatest potential lies. If we could shed a lot of the confusion and jargon surrounding individualised instruction, stop citing as advantages and outcomes, features that are problematic we could concentrate on individualising instruction where appropriate as the means for improving the quality of teaching and learning and for opening access to education.

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Bridging the Mathematics Gap

John Taffe
The Australian National University

ABSTRACT

In American universities and colleges the phenomenon of 'math anxiety' is attracting widespread attention, and increasing amounts of institutional resources. The anxiety arises from a mismatch between the degree of mathematical expertise courses seem to require and that actually possessed by students as they begin their tertiary education. This mismatch is by no means peculiar to the U.S. Its existence is slowly being acknowledged in Australian universities, though here there is more emphasis on academic than on psychological aspects.

The paper looks at the Australian context of this problem, discussing how it has arisen and various possible ways of attacking it. In particular it describes the operation of the advisory service at A.N.U.

John Taffe, B.A.(Monash), M.Sc.(Melb.) is the Mathematics and Statistics Adviser in the Australian National University's Communication and Study Skills Unit.

Address for Correspondence: J. Taffe, Study Skills Unit, Australian National University, P.O. Box 4, Canberra 2601 A.C.T.

Education in mathematics was not long ago generally seen as straightforward, predictably sequenced and so not in need of design effort, and of little consequence to anyone but its initiates, mathematicians. This is no longer so. Realization is slowly dawning that mathematics education is by no means simple or straightforward. The 'new maths' introduced about fifteen years ago, is now discredited. However, changes in the direction of research and applications at the highest levels of what is now a vast subject continue to filter down to tertiary and secondary education. One result is a trend away from the traditional heavy emphasis on physical science applications in secondary schools. This trend is slow in comparison with the rate of growth of applications of mathematics in industry and government. In many areas of employment and higher education demand for mathematically competent individuals is rising, the supply is falling or at any rate not keeping pace. Mathematics and its cousin, statistics, are much more widely applied than they were a decade ago. The computer technology which has made much of this increased application possible, with its awesome capacity for information storage, has given rise to fears whose most powerful expression remains Orwell's '1984'.

In incongruous and reassuring contrast is the gross ineptitude with which government departments have so far handled this technology, managing to give the impression that computers have made them less, rather than more, efficient. New communication problems have arisen, both within organizations (between staff and computers, between data processing staff and other staff) and in relations between organizations and the public. Large amounts of information are cumbersome. Mathematicians and statisticians are needed to organize and interpret it, and people well versed in the language used by these specialists are needed to translate their interpretations into forms accessible to decision makers and those affected by decisions. So we need to educate more people to use the tools and understand the language of mathematics and statistics. This is more easily said than done.

THE PROBLEM

The lack of an increase in supply to meet this demand has much to do with how mathematics and mathematics education are perceived. In the U.S. the phenomenon of 'math anxiety' has received such attention that organizations (Overcoming Math Anxiety, Mind over Math) have been established to 'help adults overcome their aversion to mathematics' (Hilton, 1981). Mathematics, it seems, has polarized adult society into two groups - those averse to it and those not averse, with the former having the numbers (in the political sense).

The reasons for this polarization are probably mostly to be found, as an American professor (Hilton, 1981) suggests, in how mathematics is taught in primary and secondary schools. Among the ills associated with mathematical education at school he lists 'dehumanization, artificiality, authoritarianism and dishonesty'. Though there is no doubt room for improvement in school mathematics teaching, the issues are complex, and it is not the intention of this paper to canvass them. In Britain the Cockcroft Committee (Geddes, 1982) has just taken about four years to report on these issues, giving a lead which Australia would do well to follow. The problems associated with deciding how and what mathematics should be taught at school are mirrored at the level of tertiary education. Applications of mathematics in research help to shape teaching, but the shaping process is slow compared to the rate at which applications change. Two Americans (Lax and Groat, 1981) observe, in an essay on 'Learning Mathematics',

> "... while university teaching and research go hand in hand when students are ready, they part company more and more as the gap widens between what students can do and what universities can offer. The most efficient way to solve the dilemma in the long run is to insist on adequate pre-college training; in the meantime the gap must be bridged by efforts within the university" (p.84).

The gap must be bridged not only 'in the meantime' but from now on. The 'meantime' will last indefinitely. The spread of mathematical and statistical modelling into traditionally non-mathematical disciplines is not likely to recede or be halted. The list of subject areas at tertiary level which now employ some such modelling now includes

economics, psychology, sociology, anthropology, prehistory, geography, history, linguistics, political and life sciences. Some of these already rely heavily on mathematical models, while others are only beginning to use them. The use of these models and techniques seems to share with entropy the property of being able to change only in the direction of increase. This means that teaching in these subject areas is becoming a more demanding task for tertiary teachers, whether or not students have 'adequate pre-college training'. And while it is convenient for universities to 'insist' on adequacy of training it is difficult to specify what 'adequate' means. One ingredient in such a preparation would be some degree of co-ordination 'across the curriculum' of presentation and terminology in treatments of data and models. What is called a bar chart in the mathematics class should not be called a histogram in the geography class.

A second factor helping to widen the gap is the increasing variety in the educational background of students entering tertiary institutions. This variety has two main sources - the increasing proportions of part-time and mature age students and the trend away from uniformity in secondary school programs of study. Part-time and mature age students have the benefit of greater experience of the world (compared to school leavers) to bring to their studies. They have had varying periods of time during which they have done no formal study and have attended a variety of secondary schools in different systems and countries. Often their verbal skills have been sharpened during their absence from formal education, but their mathematical skills have nearly always fallen into decline. This is the group most prone to 'math anxiety'.

School leavers are less likely to be anxious, but many have similar problems coping with the mathematical demands of their courses. At school they are likely to have had an amount of latitude in choosing how much and what kind of mathematics to do which was not possible a decade ago. The planning which goes into these decisions may be largely left up to the student. With little guidance available, decisions about what maths to take are often made without reference to the requirements of 'non-mathematical' subjects the student may wish to pursue after the end of secondary education. Some of these subjects - economics, biology, geography - become 'mathematical' only at university or college, and this is a shock to many. So decisions about further maths at school tend to be based on experience in learning it so far. As one ANU student remarked, school maths is characterized by 'instant feedback' - the student is constantly and quickly reassured by his right answers, or disappointed at finding his answers are wrong. This contrasts with the slower and less decisive evaluation procedures in, say, English. The 'instant feedback' encourages early self-categorization as 'good at maths' or otherwise. Since maths tends to be kept in a compartment separate from other subjects there is no apparent risk in ignoring it as much as possible for those who see themselves as 'bad at maths'. The pressure to gain high tertiary entrance scores encourages this attitude.

The compartmental approach is just as much in evidence in tertiary education, or at least in universities. The main effort in mathematics and statistics teaching goes into theoretical courses given to potential mathematicians and statisticians. These students commonly have little or no access to 'real world' problems requiring mathematical analysis. Such problems abound in the results of research in departments teaching other subjects - botany, zoology, geography, and so on. On the other hand, students in botany, zoology and geography may receive little or no teaching in the use of mathematical models. In psychology, sociology, economics, agricultural economics, forestry and education, mathematical tools have been in use for some time. Students in these subjects are given courses in quantitative methods which steer uncertainly between theoretical and 'cookbook' approaches, sometimes with a dose of computer data analysis package work. Large numbers of students find these courses quite incomprehensible and are unable to apply the techniques treated in them when the need arises in later work. At worst these courses are seen by students as sets of rules for arcane procedures, which serve to hinder rather than aid their understanding.

The 'mathematics gap', then, is a disparity or mismatch between the ability to use or understand argument based on the application of mathematical modelling which is assumed or called upon by tertiary courses of study and that which the students possess. It is a widening gap.

IMPROVING THE SITUATION

Recognizing that there is a problem is always the first step towards solving it. The existence of the mathematics gap must be brought to the attention of secondary and tertiary teachers. A combined effort from these two groups would appear to be essential. Unfortunately, history seems to indicate that such co-operation is not likely to be easily achieved. Secondary and tertiary teachers in Australia do not communicate regularly and so are not in touch with each other's thinking. Indeed, both groups show signs of harbouring suspicions that the other is bent on making their lives difficult. Academics would like their first-year students to arrive from school with carbon-copy mathematical qualifications. "Let us return to uniform syllabuses for sequential subjects!" pleads a recent correspondent to the Melbourne 'Age' (Watterson, 1982). Secondary teachers, on the other hand, like to point out that preparing students for tertiary study is only one of their responsibilities, and one whose influence is disproportionately large. So the prospects for co-ordinated effort on anything but a minuscule scale do not look bright in the short term. This should not, however, prevent us from keeping it in sight as a long-term goal.

Returning to the advice from the authors of 'Learning Mathematics', what kind of 'efforts within the university' might be considered? It will be convenient to classify such efforts according to their scale. The probability that such efforts will be made, it might be ventured, would vary inversely with their scale. Or, to take a more optimistic view, the length of time from now till the eventual fruition of the efforts will be proportional to their scale.

On the largest scale, universities and colleges can review their students' needs for expertise in applying mathematics and statistics across the curriculum, and revise the organization, methods and content of their teaching accordingly. Informed about the needs, they could consider a range of options, which may include:

> joint appointments between departments responsible for mathematics and statistics teaching and those other departments whose requirements are substantial - these may be, for example, economics, psychology and sociology;
>
> small liaison committees, or persons designated as responsible for liaison on teaching mathematical modelling, who would review syllabuses, organize joint seminars and lectures and generally promote co-operation;
>
> provision (perhaps in mathematics and statistics departments) of people who have time available in which they may be consulted on the teaching of applications of mathematics by members of other departments;
>
> advisers to help students directly with problems associated with learning mathematics and applying its techniques.

These suggestions are arranged in order of the magnitude of effort they would require, and thus in order of increasing likelihood. They represent a selection of possible approaches, not an exhaustive catalogue. Nor are they meant to be mutually exclusive. In an ideal world the larger scale initiatives would surely be the best. In the real world there is no experience, at least in Australia, by which to judge them. All that can be said is that the success of large scale schemes must depend heavily on the qualities and experience of the staff involved, as well as on how well they communicate and on the institution's ability to organize things smoothly. It is therefore probable that they may not be easily transplantable from one university or college to another. With small scale operations, which could perhaps be the seeds from which larger ones grow, the transplanting would present fewer difficulties.

Such an operation is the service provided at the Australian National University, within the Communication and Study Skills Unit (CSSU) by the Mathematics and Statistics Adviser. The two other professional staff of this Unit help students learn to handle written academic communication effectively - to negotiate the problems of essay and thesis writing and to derive the educational benefit these tasks are meant to provide.

The maths adviser's role is similar; the differences are those implied by the different kinds of learning tasks facing the students - organizing ideas into prose on one hand and using mathematical ideas to organize arguments involving quantities on the other. There is widespread and growing acceptance on the part of universities of the need for 'language' advisers, and their existence under many different guises and administrative arrangements is proof of the 'transplantability' of this approach to an academic problem. The time is ripe for a similar expansion in the field of quantitative reasoning.

At ANU the adviser works mainly through individual interviews with students. Most come as a result of their own decision to seek help, some at the suggestion of a lecturer or tutor. There is no attempt to screen students on a wholesale basis in order to diagnose their problems and give them the mathematics they need, as there is in some places. Where departments request a diagnostic test the adviser constructs one, and the follow-up is in the form of a suggestion to those whom the test indicates have problems that they may use the CSSU service if they wish.

The system of self referral has the advantage that students ask advice because they wish to learn. In the best of all possible worlds all students would attend lectures for the same reason - but we don't live there. Some have only the extrinsic motivation engendered by fear of the examination chopper, others wish to understand a mathematical model in order to better understand the situation it approximates. Most teachers will agree that any motivation is better than none, though the extrinsic kind is usually less productive.

Individual tuition has the advantage that assumptions about previous mathematical experience may be as few as possible. Students can begin from different starting points and proceed to different points at different rates without producing confusion. Though some direct teaching of mathematical concepts is usually necessary, attention in these individual sessions is focussed mainly on how to learn mathematics. The aim is to help students take the first steps toward independent learning and mathematical maturity.

At times when the adviser's services are in strong demand groups of two, three or four are formed, provided that they agree that their problems are similar. This proviso is necessary because teaching is always task-centred. Through experience the adviser has become very reluctant to offer 'general' introductory or refresher courses on an individual basis, because without a specific goal in mind students invariably lose direction and interest. Short courses are, however, given to groups of eight to fifteen students from time to time. Before first term there are introductory statistics courses for students with little mathematical training who are enrolled in social science subjects. The majority of these students are mature age and of these, many are also part-time. The course offers some experience in organizing numerical data which leads to a discussion of the nature of statistical inference, foreshadowing some of the content of 'methods' courses.

On a different level are courses in elementary statistics given to postgraduate students of biological sciences. These students often have large data sets demanding statistical analysis, but little or no experience or training in statistics or the use of computer software packages. Their need for courses indicates that normal undergraduate courses have created or failed to close part of the mathematics gap.

Both courses and individual tuition would be of less benefit to students without regular communication between the adviser and academic staff. The two-way flow of information and opinion between these parties can ultimately lead to better learning situations for students.

The advisory service is an efficient way of bridging the gap for students who use it (about 100-150 each year), but these are probably only a fraction of those who may be able to benefit from a more comprehensive approach. It is biassed in favour of those who seek out and make use of services and against those who do not. Women are significantly over-represented, and possibly this is an aspect of the same bias. That this bias in favour of those who make the most of their opportunities is not the exclusive property of universities should not be an excuse for complacency.

The CSSU service is a small suspension bridge across the gap. In the 80's and 90's something more on the scale of the Harbour Bridge may be required.

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The Implications of Multiculturalism in Tertiary Physics Teaching and Learning

P. Logan and D. Bailey
N.S.W. Institute of Technology

ABSTRACT

Due to changes in Australia's immigration profile over the last 15 years Sydney has become more of a multicultural city. It is felt that the implications of this should be appreciated in the classrooms of tertiary institutions. A comparison of the teaching difficulties experienced by the authors at two widely different establishments (The Papua New Guinea University of Technology and the N.S.W. Institute of Technology) has revealed surprising similarities in the problems and hopefully the solutions.

This paper discusses some of the initiatives being undertaken in the Applied Physics Department of the N.S.W. Institute of Technology, to come to grips with the challenge of multiculturalism in the Physics classroom. These include - diagnostic testing for Physics readiness, Piagetian development and language comprehension, the development of the Junior Physics Centre, Computer Aided Learning, and the use of videocassette recorders and other audiovisual aids.

Many of the initiatives are in their early stages of development however the overall concept of multipath Physics education will be discussed.

P. Logan grew up in Sydney but left in 1965 to undertake postgraduate research on high speed fluid mechanics in Canberra. This was followed by 10 years teaching Physics in Papua New Guinea at the Papua New Guinea University of Technology (Unitech). While in PNG his research interest changed to "Physics Education in a Cross Cultural Environment"; a related research interest was "Appropriate Technology". In 1981 he returned to Sydney to a position at the N.S.W. Institute of Technology. On his return he found a very different Sydney to the one he had left 15 years before, it was much more multicultural and more aware of the implications of that multiculturalism.

D. Bailey M.Sc.(W.A.), Dip.Ed. (K.C.A.E.) grew up in Perth and came to Sydney in 1964 to do postgraduate research in Single Crystal X-ray Diffraction. He moved to the Institute of Technology in 1967 and has been associated with various innovations in teaching Physics. His current special interest is in the use of computers in Physics Education. He has other research interests in Microelectronics and aspects of Diffraction Theory.

Address for Correspondence: D. Bailey, Dept. of Physics, N.S.W. Institute of Technology, P.O. Box 123, Broadway 2007 N.S.W.

INTRODUCTION

This paper discusses an educational research project concerned with the teaching of tertiary Physics at the New South Wales Institute of Technology (NSWIT). This project has only recently commenced and the paper discusses the background of the project, what has been achieved already and the direction for future developments. The aim of the project is to provide a better learning environment for physics students at the Institute.

This paper not only discusses the teaching of Physics at NSWIT, but also discusses some comparisons with similar teaching problems in PNG and the relevance of some of the insights gained in the Third World.

TEACHING AND LEARNING DIFFICULTIES

The problems associated with the teaching and learning of Physics in a cross cultural environment, like PNG, has been documented elsewhere (Logan(1976), Logan(1978) and Logan(1981). A Physics class at Unitech contains a great diversity of cultures, a class could consist of Europeans, Chinese, Mixed Race, Islanders, Coastals, Highlanders, and possibly students from other countries in the South Pacific. There are over 700 different languages in PNG alone and one particular Physics class had 97 students speaking 76 different first languages. The students are at different levels of sophistication due mainly to the length of contact of their society with western civilization. The standard of education varies between the provinces, and thosestudents from remote areas are at a considerable disadvantage compared with students from urban areas.

It is instructive to list some of the suggested causes of learning difficulties experienced by science students in a cross cultural educational environment. These include the student problems: lack of ability, poor background, poor motivation, slow cognitive development, weak vocabulary, poor comprehension of English, specific conceptual problems, unwillingness to work hard and poor study habits. The teacher problems include poor teacher expectation, unsuitable teaching staff with poor English accent and correctness, poor teaching, lack of appreciation of the student's background, and ethnocentric attitudes. The institutional problems include unsuitable curriculum, poor organisation in the college, overloaded timetableS and poor staff-student relations.

At NSWIT, the Higher School Certificate (HSC) cutoff for students entering the Applied Physics course is 240 (out of 500) whereas for the science courses at the Universities in Sydney the cutoff is 270. Hence a large proportion of students entering have HSC aggregates between 240 and 270 (for the 1982 intake it was about 65%). However because of the applied nature of the course and with two semesters of work experience included, a small number of good students also enrol (in 1982 15% had HSC aggregates above 370). This results in a large range of abilities within the Physics class. Furthermore, the intake has a large proportion of students from ethnic groups. For the 1982 intake, 65% claimed non British ancestry with over 40% of the intake born outside Australia and from a diversity of backgrounds - Eastern and Western Europe, the Indian Subcontinent, South East Asia, Pacific Islands and South America. Hence the outstanding feature of the student intake is its diversity both in academic achievement and cultural heritage.

It is a matter of concern that an extremely large percentage of students who enter tertiary courses at the N.S.W. Institute of Technolgy do not complete their studies (AUTUMN COHORT STUDY, 1981). For the Faculty of Science 23% overall graduated, 28% were still continuing their studies in Autumn 1980 and 51% had discontinued. the figures for the School of Physics and Materials were somewhat different in that only 3% had graduated and 35% were still in the course while 62% had discontinued.

Whilst accepting that some students discontinue or fail for reasons outside our cognisance, and due to factors beyond our control, the fact is that our experience in teaching these students leads us to conclude that there are some identifiable common factors.

Continued monitoring has indicated that "no previous experience in Physics or Chemistry at H.S.C. level combined with 2U Mathematics and a low aggregate" are a fatal combination. Early work has shown that students with this combination had a 95% probability of failing on their first attempt at tertiary Physics and even the provision of an extra tutorial/work session only reduced the failure probability to 75%.

If these failing students were disinterested or unmotivated students the problem could be dismissed as another case of " Well ! What do you expect. " However, this is not so. Many of the students desperately wish to pass and some only succeed on the third attempt.

REACTIONS TO THESE PROBLEMS

In PNG, tertiary physics was taught in only three institutions throughout the country:- the University of Papua New Guinea, the Goroka Teachers College and Unitech. As a result there was was close cooperation between all three Physics Departments. Tests designed by the Educational Research Unit (ERU) at the University of PNG were administered on all 3 campuses.

A number of the problems outlined earlier in this paper involved language. Studies by the ERU included "The Comprehension of Some Commomly Used Words"(Jones 1972), "Cognitive Studies With Students"(Jones 1973), "Quantitative Concepts and the Vernacular"(Jones 1974), "Classification Systems and the Vernacular"(Jones 1976), and "The PNG Dialect of English"(Smith 1978). In addition to the ERU tests, various tests on Piagetian development and visual memory were administered by the Maths Learning Centre (MLC) at Unitech. The Physics Department at Unitech administered Maths and Physics Readiness tests based on the ACER tests but modified to make them more suitable for incoming PNG students.

Hence a large amount of information had been collected to make the lecturer aware of the difficulties faced by science students in PNG. At Unitech, the Teaching and Learning Committee ran numerous workshops involving different aspects of cross cultural education. The Physics Department was concerned with offering the best possible course for students with a wide diversity in both language and academic background. The whole of the first year course was available on sound cassette/booklet combinations so students could revise any section of the course they did not understand. Also available were Computer Assisted Instruction(CAI) programs in which students could work through a problem and receive assistance from the computer in case of difficulties. CAI programs were available for each part of the course. A videosystem was available in the department and films held by the library were edited with additional segments of local interest added to make them more suitable for PNG students and courses. If there were no suitable films on a particular topic, the facilities were available within the Department to make their own videotapes.

In the Applied Physics Department at NSWIT, there were the occassional questionnaires given to students on completion of a course to determine their attitude to different aspects of the course. Furthermore there were studies on the correlation of HSC aggregate and performance in the course. It was found that the HSC aggregate correlates well with performance at the Institute. This has lead to a maxim in the department that a HSC aggregate of over 300 is required to do well in the course. However there has never been a comprehensive longitudinal study.

Two features have been introduced into the Junior Physics course to assist the students:- tutorial booklets and the Junior Physics Centre (JPC). Apart from these the teaching of Physics in the junior stages is similar to that in most other tertiary institutions with lectures, tutorials and laboratory work. The lecture courses are supported by a comprehensive set of tutorial booklets for each course. In each booklet there is a statement of the syllabus, details for that topic, a brief statement of the theory covered in the topic (essentially an expansion of the syllabus), worked examples and then graded examples which have answers but no worked solutions. At the back of the booklet there are examples of past exam questions specifically on that topic area so that the students can immediately see the level of difficulty and the standard expected by the end of the course. These booklets are used in conjunction with the JPC which is a room set aside for student use as a reference centre where the students can work on their own study program or they can get help from an academic with any of the Junior Physics tutorial problems, with the laboratory work or the theory covered in the lecture course. The JPC is manned for about 20 hours a week both during the day and in the evening for the benefit of part-time students.

Students entering the Institute often have a negative attitude towards Physics and are not well motivated. The Applied Physics department commissioned a market survey which discovered that a widespread negative attitude towards Physics existed among high school students. Those surveyed said they felt Physics was dull and difficult. Their view of a physicist was that of a laboratory coated, grey haired, Einstein like, absent minded researcher (We feel part of the responsibilty of this is due to the way TV often portrays scientists, take for example the Muppet show).

Furthermore students had little idea that physicists could be employed in industry and no idea of the extent of the demand for graduates in Physics. Our work experience program had previously been called "Cooperative Education", a name which was not understood by students. In the present climate of inflation and unemployment, students were concerned that there should be jobs at the end of the course and thought that paid "work experience" with the department finding them jobs was an excellent scheme.

As a result of the survey a poster and a brochure was prepared by the market research team. The poster plus brochures were distributed to every high school in the state.

The purpose of the campaign was not only to increase the numbers of students entering the undergraduate course in Physics but also to attract more able students. These tend to enter traditional university courses rather than applied courses as the ones offered by the Institute.

PHYSICS AT NSWIT

It was with this background that Logan and Bailey, in late 1981, began their research project described in this paper. The aim of the project is to provide a better learning environment for physics students at the Institute. The project will involve a study of the performance of physics students throughout their course at the Institute. Furthermore, diagnostic tests will be used to see if there are good predictors of a student's performance. This is not to label the students as "pass" or "fail" at an early stage in their course, but rather to provide the "weaker" students or "students at risk" with remedial material. The Physics 1 course is broken into smaller groups of about 16 students for laboratory classes, hence it would be possible to have groupings according to similar abilities, in order to provide a more conducive learning environment and to provide remedial activities for these groups.

What we are seeking is a diagnostic test which would identify more readily and reliably the students at risk and the reasons for their lack of success. If this can be done then perhaps we can also provide the right remedial climate so that those students can overcome their handicaps and successfully complete their courses.

Since we have been teaching these students over a considerable period of time we have our own ideas as to the reasons for student failure. These can be identified as:

1. Lack of background in the subject.
   i.e. Physics readiness.
2. Lack of mathematical skills needed for the course.
3. Lack of vocabulary and language comprehension.
4. An unreadiness for formal presentation of syllabus material. In Piagetian terms they are still substantially at the concrete stage of development.

There is no prerequisite knowledge of Physics required for entry to the Applied Physics Degree course. This is not seen as a major disadvantage since the course starts at a low level to take this into account. The implicit assumption behind this approach is that the students possess enough familiarity with English and general scientific language and that we are only presenting new material which builds on a previous background. That this is not so is confronting the lecturers more each year as the classes are found to contain more and more students with " English as a second language " problems. The other side of this problem is that the students are also faced with language problems due to the lecturers being of foreign extraction with accent difficulties or even in the case of some lecturers variations from full Queen's english through to drawled Australian slanguage. Compared to these problems the traditional problems of lecturers talking to a blackboard pale into insignificance. Any solution to the language problem has to recognise both sides of the teaching situation. We have listed in Appendix 1 what we consider to be some desireable abilities for students entering our courses.

The testing of the students mathematical skills is already being carried out by the Mathematics Department. Whether a correlation exists has not yet been determined.

The last factor considered as worthy of examination is the concrete-formal transition. If students are entering a formal course situation whilst still unable to think at that level then we are obviously going to observe problems. We think that this is present among a number of our students and that we should attempt to identify the Piagetian level of our students and if possible involve the students in any remedial program which will increase their ability to handle abstract concepts.

A student questionnaire was prepared and administered to the students prior to any contact with the Physics course. Not only did it ask about the students HSC aggregate, marks in Physics, Maths and English but also their initial attitude towards Physics, why they were doing Physics, what languages they spoke and their ancestry.

The Physics Readiness test included some elementary numerical substitution and some questions on basic physics knowledge. Some questions similar to the ACER tests were used.

A Maths Readiness Test was not prepared because the Maths Department also give the students a test and we had hoped to use the results from that. However the Maths Department does not keep records and hence we do not have those results. We will prepare our own Maths test for next year.

The usual Piagetian test requires a clinical (1 to 1) administration. However a written test was designed based on other written Piagetian tests (Sheenan (1970), d'Avila(1977) ,Lawson (1978)). The concepts tested were :- perspective, horizonality, conservation(mass and volume), probability, ratio and proportion, equilibrium, exclusion of variables and logic. There were three questions on each concept and students were asked not only to record their answer but also to explain the reason for their answer. The results for the Physics 1 class are given in Table 1.

TABLE 1 Piagetian Testing

Results from 144 Physics 1 Students

Concept	Number Completely Correct	%
perspective	127	88
horizonality	132	92
conservation	92	64
probability	58	40
ratio and proportion	102	71
equilibrium	73	51
exclusion of variables	85	59
logic	16	11
all concepts	3	2

The results from these test will form the basis of a full study to assess problems students face, and to provide pathways to assist the " weaker " students.

Recently some audiovisual aids were purchased especially to provide remedial activities. These included sound cassette players, a tape/slide projector, two Apple computers, and a videocassette recorder. The sound cassette recorders will be used to prepare introductory tapes to be used in conjunction with mounted photographs for laboraory experiments, and also for remedial cassette/booklet packages. It is hoped to produce tape/slide sequences for the JPC. The Apple computers will also be used in conjuction with the JPC for computer assisted instruction. The word processing facility will be used to prepare Junior Physics material, including a data bank of test items. One special use of the videorecorder is in the recording of everyday events (such as projectile motion, collisions, and circular motion) and then slowing it down to look at the Physics in more detail with measurements taken off the monitor. The videorecorder can also be used for lecturettes on syllabus material.

A MULTIPATH APPROACH

The fundamental tenet of modern cross cultural education is the " different " not " deficient " model, and the belief that anything can be taught to any pupil in an intellectually honest form at any stage of development. Members of minority groups should be regarded as different and these differences need to be taken into account in the educational process. Previously, minorities wre regarded as " deficient " and hence they needed to be made more like the average (White, Anglo-Saxon ?) student in all respects. The more like the dominant culture they became, the more successful they were in the educational system.

People from minority groups are different in a number of ways. Quite often they have different dialects or different languages from the language of instruction. The implications of this has been discussed elsewhere (Logan 1981).

Related to the language differences there are conceptual differences; the way an ethnic group classifies events happening around it is manifested in the language of the group. A different language would mean a different classification and a different worldview. Science has "grown up" in the context of Indo-European languages, whereas speakers of other languages will have quite a different conceptual framework, and hence a different "Science". Whorf (1973) the linguist who has popularised this theory (linguistic relativity theory) talks of Hopi Physics. Because of the different ways in which things are classified and the different needs of different societies, ethnic groups have heightened abilities in different areas. For example, desert Aborigines in Australia have exceptionally good spatial memories (Kearins (1976)).

There are cultural and social differences; the white education system is highly competitive and individualistic, whereas some other ethnic groups regard coope ation and collectivism as highly desirable. Traditionally education may have been much less formal with the emphasis placed on learning by doing.

These are just some of the differences which must be considered when teaching Physics in a multicultural environment. There would appear to be two ways in which to proceed; We can try to discover the heightened abilities and different conceptual frameworks of the students and incorporate these features into our teaching. With many cultures present in the same class this is difficult, if not impossible. Alternatively we can provide alternative pathways for students to study the material and let the student choose the particular path that suits his academic, psychological, cultural, and social background.

In a previous paper (Logan 1976), various teaching strategies were discussed to help the "weaker" or "deficient" students. They were thought of as remedial strategies to solve particular problems, with the main teaching done through the lecture, laboratory and tutorial. These were seen as the three essential features of the course; lectures presented new material, tutorials discussed the material, and laboratories studied the material experimentally. Each was independent to some extent and students required all three.

However on a study leave in the USA, Logan met several physicists who had introduced alternative pathways into their physics courses. These included, courses offered by lectures or computer assisted instruction (University of California, Irvine) and evaluation by a written examination or project (University of Utah).

Furthermore, there were various articles being written at the time on the danger of a single pathway. Scorer(1973) warned of the danger of the monoculture in the fields of economics and politics. He argued that strength did not come in unity but rather in diversity. Strong single systems whether central governments, marketing boards or international communities tended to be unproductive, inefficient and unstable. A similar sentiment was expressed by Bork's "Let a Thousand Flowers Bloom"(1971). His flowers were the different modes of instruction currently being used to teach College Physics.

Due to the factors mentioned here - Scorer's concept of diversity, the cultural diversity of the student body, and the alternative pathways, Logan introduced alternative pathways into the courses at Unitech. Various teaching strategies had been developed over the years. In each case, instead of looking to the new strategy to be merely for remedial assistance, the material was developed to make it as complete and independent as possible so that it is an alternate pathway for at least part of the course. Some parts of the course such as particular experiments can only be offered by one path.

It is expected that a multipath approach would be especially applicable to colleges where students come from a variety of academic, psychological, cultural and social backgrounds.

CONCLUSION

This paper has discussed some of the initiatives being undertaken in the Applied Physics Department of the New South Wales Institute of Technology, to come to grips with the challenge of multiculturalism in the Physics classroom. These included - diagnostic testing for Physics Readiness and Piagetian Development; the development of the Junior Physics Centre; Computer assisted instruction; and the use of videocassette recorders and other audiovisual aids .

Many of the initiatives discussed in this paper are in the early stages of their development. An overlying concept of multipath instruction was also briefly discussed.

APPENDIX 1

ABILITIES DESIRED FOR FIRST YEAR ENTRANTS INTO THE APPLIED PHYSICS DEGREE COURSE AT THE N.S.W. INSTITUTE OF TECHNOLOGY.

1. Knowledge and understanding of.

Terms, conventions and units commonly used in science. (i.e pica, nana, micro, milli, kilo, mega, giga, tera, force, tension, work, energy, velocity, speed, acceleration, mass, weight, inertia, momentum, potential, power, vectors, scalars, fields, charge, current, resitance, torque, couple, centripetal force, Newtons, Pascals, Joules, Teslas, Watts, Metres, Amps, Ohms, Volts.)

Particular principles (or laws) and generalisations of science, and their effects and inter-relationships. (Ohm's Law, Newton's Laws of Motion, Conservation Laws, Conditions for Equilibrium.)

Specialist apparatus and techniques used for the demonstration of the principles referred to above, and the limitations of such apparatus and techniques.(i.e. micrometer, vernier calipers, stopwatch & metre rule.)

The use of different types of apparatus and techniques in the solutions of scientific problems.

2. Abilities.

Understand and interpret scientific and other information presented verbally, mathematically, graphically and by drawing.

Appreciate the amount of information required to solve a particular problem.

Understand how the main facts , generalisations and theories of science can provide explanations of familiar phenomena.

Recognise the scope, specification and requirements of a problem.

Understand the operation and use of scientific apparatus and equipment.

Recognise the analogue of a problem in related fields of science and practice.

3. Ability: Communication.

Explain principles, phenomena, problems and applications adequately in simple English.

Formulate relationships in verbal, graphical or diagrammatic terms.(This is tested in tutorials and seminars throughout the course in a progressive manner.)

Present the results of practical work in the form of reports which are complete, readily understandable and objective. (This will be covered in the Departments graduated practical work program with no assumptions of prior knowl edge or experience.)

4. Ability: Analysis.

Break down a problem into its separate parts.

Recognise unstated assumptions.

Acquire, select and apply known information, laws and principles to routine problems and to unfamiliar problems, or those presented in a novel manner.

5. Ability: Synthesis and Design.

Design the manner in which an optimum solution may be obtained and to propose, where necessary, alternative solutions.

Make formal specification of a design or scheme.

Make a plan for the execution or manufacture of the design or scheme.

Use observations to make generalisations or formulate hypotheses.

Suggest new questions and predictions which arise from these hypotheses.

Suggest methods of testing these questions and predictions.

6. Ability: Evaluation and Judgement.

Check that hypotheses are consistent with given information, to recognise the significance of unstated assumptions, and to discriminate between hypotheses.

Assess the validity and accuracy of data, observations, statements and conclusions.

Assess the design of apparatus or equipment in terms of the results obtained and the effect upon the environment and suggest means of improvement.

Judge the relative importance of all the factors that comprise a scientific situation.

Appreciate the significance of social, economic, or design considerations in a scientific situation.

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The Mileage Marathon Competition An Exercise in Realistic Engineering Education

R.P. Wellington
Chisholm Institute of Technology

ABSTRACT

The Mileage Marathon is a competition for specially designed vehicles intended to produce the maximum fuel efficiency possible. The students and staff of the Mechanical Engineering Department, Chisholm Institute of Technology have built two vehicles which have been highly successful in this competition. This paper is an attempt to discuss the educational benefits which can accrue from large scale projects requiring expertise from a variety of sources, with the Mileage Marathon project serving as a case study. The study discusses some of the technical benefits but concentrates on improvement of knowledge and skills in areas such as communication, organisation and industrial relations.

R.P. Wellington, B.Sc.(Hons.), M.Ed., ARACI, is a lecturer in Mechanical Engineering. After spending five years in industry, he joined the Institute to teach Materials Engineering. He has co-ordinated departmental projects for the last six years and has acted as Project Manager for the Mileage Marathon vehicles since 1979.

Address for Correspondence: Mr. R.P. Wellington, Dept. of Mechanical Engineering, Chisholm Institute of Technology, 900 Dandenong Road, Caulfield East 3145 Victoria.

One of the major problems threatening the established way of life of much of the Western World in the 1970's was the prospect of dwindling oil supplies and the reality of rapidly escalating petrol costs. Accordingly, motorists changed to smaller cars and automotive engineers aimed at ways of increasing vehicle efficiency. In this climate, the Shell Company, first in England but later in Australia, sponsored a competition (called the 'Mileage Marathon') for specially built fuel efficient vehicles.

The opportunity to design and manufacture a vehicle to enter in this competition, appealed to the overwhelming number of staff and students of the Mechanical Engineering Department of Caulfield (recently renamed Chisholm) Institute of Technology, when the Mileage Marathon was first announced in 1979.

The purpose of this paper is to explore the educational benefits gained by both the students and staff involved during 1980 and 1981, through building two vehicles which were entered in the competition. The objectives of undergraduate projects,the history of CIT's involvement in this competition, the anticipated and unanticipated benefits and problems which resulted and the subsequent trend of projects in the department will all be discussed.

Many courses in higher education provide the basis for graduates to enter a wide range of professions e.g. medicine, law and education, but in addition to the appropriate degree or, as part of that degree, time is allocated for practising the appropriate skills in a realistic situation. Hence, medical students for instance, spend much of that time in the final years of their course doing clinical work and even then, spend one year of internship after receiving their degree. For an engineering student to become a member of the Institution of Engineers, Australia, i.e. a recognised member of his profession, at least 12 weeks during his course must be spent in industry. This period is usually scheduled during the long vacations after the second or third year of studies are complete. Although many students consider this time is invaluable, it is often considered to be too short. Three common approaches to providing students with more realistic experience are -

1) to study part or all of the course on a part-time basis,
2) to undertake a sandwich course,
3) by student projects organised within the educational institution.

Although many students in the years before 1980 studied part-time for a three year diploma, there are far fewer prepared to attempt after work study now that the Institution of Engineers, Australia, only recognises the four year degree as a professional qualification.

Following the recommendation of the Percy Committee (1945) in Britain, many English technical colleges offered sandwich courses with one year or two six month periods in industry, interspersed through the course. The benefits of sandwich courses, indeed, of all types of realistic experience were summarised by Smithers (1975) who claimed -

1) they provide better integration of theory with practice,
2) student motivation is increased,
3) they enable students to mature more quickly,
4) students develop greater human relations skills,
5) students are oriented to the world of work.

However, with the changes of the most academic of these colleges into universities in the mid '60's, the number of sandwich courses leading to degree standard courses has decreased.

In Melbourne, Swinburne Institute of Technology has successfully offered sandwich courses for a number of years, but the number of suitable positions in industry is limited and further expansion of such courses (especially within the current economic climate) is unlikely to be successful.

Chisholm Engineering School has had a long history of conducting projects for final year students. The Mechanical Engineering Department has for the last four years, required both third and fourth year students to undertake project work. The purpose of this paper is not to attempt to establish the superiority of any of these options over the others, but to explore the possibilities of large scale projects, involving numbers of students working on different aspects of a central problem.

Many authors have identified ranges of skills, attitudes and functions which professional engineers should attain. Although there are obvious technical skills required, many of which are the objectives of other subjects within the course, the project seems singularly suitable to converting these theoretical skills into practice and developing attitudes and skills in many non technical areas.

In his presidential address to the Institution of Mechanical Engineers, Sir Hugh Ford (1977) said, 'Professional engineering is essentially decision taking in the creation of artefacts fit for their purpose to meet the perceived need at an acceptable price in a competitive market against a background of incomplete knowledge and uncertain boundary conditions with scarce resources of materials, men and money. Engineering enterprises consist of some or all of activities such as research, marketing, design, development, planning, manufacturing, finance, purchasing, project management, industrial relations, sociology and environmental considerations'.

This definition provides him with the basis for a discussion on engineering education, (Ford (1890)) in which he advocates an increased emphasis on synthesis instead of analysis. He also criticises a common tendency in courses to separate the subjects of 'design' and 'production' and points out the need to achieve an early appreciation of the fundamentals of management, finance, organisational sociology, quality control, safety, cost analysis and accountancy. Although some of these elements are formally taught within many engineering courses, students often view them as unrelated and only by means of practical experience, can these subjects be put into perspective and their relevance to realistic engineering be seen.

Ruiz (1980) points out that the vast majority of students will, upon graduation, form part of a team and work as part of a large organisation. He therefore recommends that communication skills and closer staff student interaction should be established in academic courses. Maillardet (1981) discusses the teaching of design in engineering courses and states - 'Probably the one area of general agreement is that actual experience of the design process is vital in order to highlight the many rather peculiar inherent difficulties. This is usually achieved by using a design study, a form of creative project where students work to conceive, develop and, ideally, manufacture and test a novel design'.

Buley (1972) in discussing the policy of employers who recruit large numbers of graduates, suggests that 'they are trying to find people who will be productive in the short term but at least some of whom will also move on to fill more senior roles in the future and will be happy to do so'.

The question now to be posed is: can projects,specifically the Mileage Marathon, help provide graduates with the range of attitudes and abilities suggested above?.

In discussions on projects with Mechanical Engineering staff and students at Chisholm, the following views were expressed about conventional projects involving one or two students -

1) The project enabled the students to gain worthwhile experience not achieved by course work.
2) Often projects gave increased insight into the more theoretical aspects of the course.
3) Projects provide students with confidence (if it is a success) in approaching new problems.
4) Manufacturing a component gives an insight into the inadequacies of students' first attempts at design (e.g. insufficient detail on dimensions, assembly methods etc.).
5) For the first time students have long term goals to be met and must learn to organise their time to achieve the required results. Although this is an important skill to learn, many students learn the hard way, i.e., by leaving too much to do until near the end of the year.
6) A minority of students find little motivation in their project although given a wide range of topics from which to select.
7) Few skills pertaining to working in a real organisation are learnt.

The deficits of conventional projects, were major factors which encouraged the proposal for a change in direction to a larger scale project viz., the Mileage Marathon.

While on study leave in England in 1977/8, the author saw several vehicles built from the English M.M. competition and advocated (Wellington 1978) that the department consider projects of this type. Accordingly, in September 1979, following the initial advertising for the first Australian Mileage Marathon scheduled for June 1980, this recommendation was again put forward. Staff saw that such a project may help overcome the problems of motivation and meeting deadlines, but also saw that a much broader range of objectives may be achieved. These included -

1) the integration of knowledge from a range of different subjects,
2) the development of greater interpersonal skills of students by closer interaction with academic and technical staff,
3) the opportunity to promote practical application of areas of knowledge seen as of little relevance by students e.g., use of fibreglass as a structural material, importance of human factors engineering in design,
4) the extension of knowledge of both staff and students into a new challenging area within the capacities of the department (in terms of equipment),
5) to meet the challenge of meeting a carefully defined specification (set of rules) in a real competitive situation,
6) to increase the knowledge of general approaches to vehicle design for efficiency for all students especially those who go into the automotive industry. It had been found, Wellington (1976), that approximately one third of the Department's graduates were first employed in this industry,
7) that this was a project which would provide some kudos for the Department (then under threat from the Partridge Report).

There was however, considerable doubt that the deadline could be met or that the Department would have the resources. Despite these concerns, it was decided to arrange a departmental meeting for all staff (academic and technical) and students to ascertain the level of interest. The support was overwhelming and the decision made that the Mileage Marathon design and construction would become the topic for the final third year design exercise in 1979, and the focus for 6 third or fourth year projects in 1980.

The third year design exercise aimed at analysing the photos and press discussion of the 1979 English winning vehicle from King's College, London and, simultaneously, calculating the required engine size, steering mechanism, body design from first principles. After four weeks calculation and discussion, students tendered and argued for their ideas on each of these aspects. It was decided (by general agreement) that the CIT vehicle should be a three wheeler with two wheels in the front on a simple beam axle steered by a tiller. The driver would lie in a supine position and drive the car using an accelerate and coast method. The theoretically ideal engine was agreed as a 4 or 5 cc, 4 stroke running continuously, but no suitable model engines of this size were then available. Hence, the final engine chosen was a 50 cc minibike engine which would accelerate the vehicle to 30 km/hr. before being switched off allowing the car to coast. When it had slowed to 20 km/hr, the engine would be restarted and accelerate back to 30 km/hr, thus achieving the required minimum speed of 25 km/hr. It was also decided that the lightest, most aerodynamic body could be made from a modified canoe shell.

In 1980, three or four students sacrificed one month of their long vacation to start building the car which (with work carried out by two other students four academic and four technical staff) was finished in time for testing in May. The deadline was barely met with the car track tested only eight hours before leaving for practise in Sydney two weeks before the competition itself. The practise was successful, with CIT being the first and only car present to exceed 1,000 miles per gallon. The competition required each car to complete ten laps of the 1.4 km circuit in approximately 34 minutes. The fuel consumed was measured and calculated in terms of miles per gallon. In the actual competition, the CIT vehicle posted a result of 1,232 mpg - fourth overall and best of the colleges and universities but disappointing in comparison to the result of 1,800 mpg achieved in our final practise run.

In 1981, the original car (designated project 80) was up-graded and a new vehicle (project 81) was built. Ten students undertook Mileage Marathon projects under the supervision of six staff members and with the help of five technicians. The second car used a CIT designed and built fibreglass body and was designed to be powered by a 5 cc and a 10 cc engine used together for starting but the 10 cc engine was to be disconnected once the vehicle was up to speed and the 5 cc was to be used

alone to maintain speed. This second vehicle had many new technical innovations but there were electrical problems on the day of the competition and it did not start. Project 80, however, returned 2,011 miles per gallon to again be the best of the college and university entrants and again come fourth behind vehicles built by engineers from the Aeronautical Research Laboratories and Ford as well as a well known racing car driver.

Thus the project had been a significant technical and, we believe, educational success , attributable to many factors.

The following are a list of the most important benefits achieved by this project as assessed by the author's own involvement and observation, the comments of students in questionnaires and interviews and the comments of some of the staff in recent discussions.

1. The Range of Expertise Used

Few other competitors brought the diversity of interest to bear on the problem that CIT did. Projects were supervised by staff whose expertise lay in the areas of design, thermodynamics, materials, aerodynamics, vibrations and technical assistance was provided by qualified fitters and turners,a motor mechanic and electrician.

2. Communication Skills

A communication network was established by weekly meetings in which all students reported on progress and problems between different areas were solved. Students learnt not only to present information to a large group (usually about 30 with other interested staff and students joining those formally involved), but also to justify their decisions and argue for their needs contra to the needs of another project - hence the skill of negotiating and need to compromise was made apparent even if the level of skill achieved was not great. (e.g. students working on the engine always wanted more room to work in than the aerodynamicists and body designers wanted to give them).

Many students also acknowledged the importance of close interaction with the technical staff which, as one student stated, 'was very rewarding, as it gave you a great understanding in how to approach a problem with consideration to the personnel who have to produce the item'. Another stated that advantages of the project were 'getting to know them and learning how to communicate effectively with them', i.e., the technical staff.

3. Organisational Decision Making

A major requirement of an engineer is the making of decisions, often where many conflicting requirements exist. This rarely occurs in other subjects except 'Design', but in this project many realistic decisions were made. Many students had to make their own minor design decisions in their own areas and overall decisions were made by an informal staff group or by democratic process in the weekly meetings. This decision making process is seen by some staff as to inefficient and the nomination of a senior design engineer to make major decisions has been suggested.

4. Finance

Although students often require materials or components to be purchased for their projects, the funding of their purchases is rarely a problem in which they are involved. However, due to the pressures of limited time, students frequently were required to contact suppliers, get quotes and justify their anticipated expenditure. The problems of raising finance were taken by staff who were able to attract initiative grants from the Institute,as well as devoting part of their departmental funds. Students however, were made aware of the financial limitations of the Department and played an active role in several fund raising schemes which were organised.

5. Interdepartmental Co-operation

Engineering students have high lecture and practical work loads taught predominantly within the Schools of Engineering and Applied Science. Subjects taught outside the Mechanical Engineering Department are sometimes viewed by students as only vaguely relevant to their course and future careers. All students intimately involved in the project were certainly made well aware of the problems associated with this view - especially as most difficulties the project met related to electrical problems and on several occasions, help from the Electrical Engineering Department proved invaluable.

Perhaps the most profound effect of this type made on the students in 1980, was made by a final year graphic design student from the Art School who was preparing a brochure on the competition as part of his course work. Not only did he produce an excellent brochure, but consulted on colour matching and also painted the lettering and Institute symbol on the car. So as not to interrupt the work of the engineering students, he spent one night from 6.00 pm to 5.00 am completing the lettering. This co-operation, enthusiasm and skill provided a much greater respect for the abilities and attitudes of art students than ever seen before in CIT engineers.

6. Encouragement of Initiative

Creativity is regarded as an important engineering skill but rarely do analytical subjects provide scope for innovative approaches. Certainly a project as this, should, and has, seen a number of innovative steps taken to improve performance - the development of an electronically controlled pressurised lubrication system and the covering of the wheel spokes with a plastic film being amongst the most impressive - the latter of these two ideas was incorporated into most of the successful entrants in the 1981 competition.

7. Development of Team Spirit

Many of the staff and students considered that "being part of a team was an important element of the enthusiasm and hence quantity of effort of those involved. One piece of evidence for this enthusiasm of staff as well as students, is the current preparation of 3 entrants in this year's competition, involving only five students directly and six to eight of the staff as well. The effort of the two prior years has solved many initial problems and greater numbers of students directly involved could not be justified. This team spirit has been fostered by close staff student contact not only in formally alloted times but over vacations , at night and weekends, frequent meetings, involvement in public presentations (e.g. this year's Melbourne Motor Show), printing of team T shirts to help raise funds and the organisation of a bus to take other interested students and staff to Sydney each year for the competition.

8. Publicity Implications

Due to the CIT vehicle achieving significant success in both years of competition, the 1980 car has been shown on TV, photographed for the local, state and national press and recently been displayed at the Melbourne and Adelaide Motor Shows. Students have stated that they feel a great sense of pride in being able to say "I helped build that". They also feel that the publicity helps bring the Department and hence, its graduates, to the attention of prospective employers, thus improving their future prospects. The Head of Department also pointed out that publicising interest and expertise in this area, may well result in offers of projects and assistance from industry. He also considered that the professional photographing and televising of the competition by some staff members had encouraged students to develop a similarly professional approach in presenting their own project reports and seminar papers.

9. Benefits to Other Students

In addition to those directly involved, there appears to have been a degree of transfer of knowledge and motivation, especially to younger students. The reference of a specific piece of theory by a number of staff in lectures or practical work to differing aspects of the vehicle, seems to increase the interest and perceived relevance of the topic being discussed. The annual trip to Sydney also seems to have helped increase the rate of socialisation of first year students and helps to provide them more rapidly with an identity.

Although the above points indicate some of the successes of this project, there are some valid criticisms of it.

i. Time Required

Probably the most serious is the excessive amount of time required. There is concern that students may sacrifice other academic studies at the expense of the project but, to date, only two of the heavily involved students have failed subjects. In one case, a special supplementary exam was set (which was passed) and in the second, the student repeated the several subjects failed. There is also great pressure on staff time, with substantial sacrifices made by both academic and technical staff working nights and weekends. There has been some concern expressed that students working on other projects may have insufficient access to technical

help but few other projects have deadlines in early June, thus minimising this problem.

ii. How Should the Student be Assessed

There has been concern expressed that with many students involved, some may achieve a pass on the basis of help from their colleagues. This is unlikely for two reasons - students are generally given clear responsibility for one aspect and secondly, staff work more closely with students than usual which prevents one student plagiarising another's efforts.

iii. Students Get Too Much Help

This is a real possibility with the need for each project aspect to meet rigid deadlines. If the student does not perform; do the staff take over? This may have happened to some extent in one or two cases but in one of those cases the student failed the project. Usually, the supervisor would intervene and set more definite shorter term goals for the wayward student, but generally this has been unnecessary.

iv. Scheduling and Organisation

The competition date of early June creates some problems with it falling near the middle of the academic year and only 3 weeks before the semester exams (final exams for some subjects). This means students only have half their year's project time to work on it. However, seven or eight students have devoted several weeks intensive work over their Summer and May vacations to their projects. This allows for a relatively easy second semester although there has been follow up work to be done in anticipation of the following year's competition.

There have been some organisational problems, due largely to the lack of available time for any one staff member to act as senior designer responsible for all organisation. Hence, some aspects have been under-emphasised and perhaps too many decisions made by committee.

Despite the above problems, Chisholm Institute has three vehicles entered in the 1982 competition and seems likely to maintain an involvement, although a decreasing one in terms of project time and effort, over the next several years. It is felt that the effort required to make small improvements in body construction, wheels etc., is unjustified but further engine development seems likely. However, the Department wishes to maintain its involvement in a large scale design - manufacturing project and is now in the process of designing and building a small on road vehicle which, we hope, will ultimately be registerable and for which a fuel consumption of 150 to 200 miles per gallon will be achieved.

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Student Perceptions as a Basis for Changing their Learning Environment

G.I. Feletti, R.M. Clarke and C.E. Engel
University of Newcastle, N.S.W.

ABSTRACT

Student perceptions have been the focus of several recent studies evaluating different Australian medical schools as effective learning environments. These studies have encountered a number of primary problems associated with research method and data analyses. However, this paper also explores the secondary problems of interpreting student perceptions as a guide to curricular change within the particular school(s) involved, and for tertiary education in general - given that significant methodology and analysis problems could be overcome. Data from several recent studies will be used to highlight the main problems.

Grahame Feletti, B.Sc.(NSW), B.A. Hons. (ANU), Ph.D. (Victoria, N.Z.) is Senior Lecturer in Medical Education at the Faculty of Medicine. As an educationalist he has helped to develop student assessment and programme evaluation, besides conducting and reporting education research projects connected with this Faculty's innovative curriculum.

Rufus Clarke, M.A., M.D., Ph.D.(Cantab.), is Professor of Anatomy in the same Faculty. He was Foundation Chairman of its Undergraduate Education Committee and has contributed substantially to the development of the Faculty's basic educational philosophy, its curriculum design and implementation.

Charles Engel is Associate Professor of Medical Education and Chairman of the Faculty's Programme Evaluation Committee. He has been instrumental in implementing the new curriculum, as well as in developing its basic educational philosophy.

Address for Correspondence: Dr. G.I. Feletti, Faculty of Medicine, University of Newcastle 2308 N.S.W.

INTRODUCTION

Students' perceptions of the learning environment should be a matter of concern to medical educators because it can be an important determinant of the learning that takes place (Hutchins, 1961). The expressed perception will reflect students' attitudes, personalities and value systems on the one hand, and the real nature of the environment on the other (Retzler, 1974). It is important to make reasonably objective measurements of student perceptions about their learning environment, as a guide to the strength of one potential source of pressure for changes in the curriculum, or for monitoring the effects of curricular change, or as a general measure of student satisfaction with the efforts of faculty (Marshall, 1978).

This paper briefly identifies several primary problems inherent in measuring students' perceptions of their medical school as a learning environment. It also outlines the secondary problems of interpreting perceptions as a guide to curricular change within the particular school(s) involved, and to improving tertiary education generally. These kinds of problems have emerged recently in several evaluation research projects conducted by the Newcastle medical school. Each project will briefly be outlined in this context, but interested readers are encouraged to review their fuller accounts in other publications listed in the References.

OUTLINE OF PRIMARY RESEARCH PROBLEMS

The primary problems associated with using students' perceptions as a basis for curricular change can be outlined in terms of evaluation planning and methodology. Briefly, one planning issue is deciding whether or not there is a need for change. Evaluators may expect differences between a traditional and a more progressive educational institution in their sensitivity to this need, and in the extent of change considered. For a new medical school like Newcastle, which also has implemented an innovative curriculum through its progressive educational philosophy, the need for change is monitored as part of the regular end-of-term programme evaluation by students and academic staff. Students' perceptions about curriculum implementation are obtained by a nominal group process conducted by the students themselves, and their evaluation of tutors' behaviour is solicited by questionnaire (Feletti and Fisher, 1979). Emphasis for change here is clearly in terms of implementation rather than in educational philosophy.

A related planning issue is to identify criteria for such change, and this seems closely tied to whether or not students' perceptions provide the only data. Even as 'consumers' of the curriculum it is unwise to consider students' perceptions as exclusive or accurate information on the real nature of their learning environment (Ware and Williams, 1975). The same reservation must apply to criteria such as majority vote, and possibly even consensus of respondents' perceptions.

Another set of primary problems arises in attempting to measure students' perceptions. First, as mentioned earlier, there is a need for objective measurement. This requires careful choice of instrument or survey method, with emphasis on its acceptability to students as respondents, and reliability and validity for subsequent interpretation by faculty. Second, the perceptions obtained must be representative of the student population. Choice of sampling strategy will also depend on the choice of instrument, as well as the size of the student population, time and resources available for data collection, and the purpose of the survey (as outlined above under planning issues). Third, whatever sampling strategy is used there is still a problem in checking the representativeness of collected data. That is, are the perceptions or selected characteristics of respondents different from those of non-respondents? This task will undoubtedly be more difficult for surveys within a large institution, and for those involving several institutions where data collection is dependent on cooperation of other colleagues. Fourth, the collection, representativeness and interpreation of students' perceptions will benefit from clearly-stated intentions of the research. Specific hypotheses about their perceptions will enable better decisions about the need for curricular change, but their choice and orientation (e.g. null- v. alternate hypotheses) can also present difficulties in interpretation.

These methodology problems were prominent in a recent Australian survey of students' perceptions of some medical schools as a learning environment by Clarke, Engel and Feletti (1981). Care was taken to select, slightly modify and pre-test an appropriate questionnaire to measure student perceptions (Feletti and Clarke, 1981). Through personal contact with the Dean and liaison (academic) staff at each medical school selected it was anticipated that response rates would be high. To further improve these chances only students in selected stages of their course were involved. This strategy was closely tied to specific hypotheses about anticipated differences between perceptions of students grouped by age at entry to their course, sex, and stage of course. However, even these plans did not preclude several problems. For example, response rates varied from 57 per cent to 90 per cent in different medical schools. There was no check on perceptions or characteristics of non-respondents. Even the orientation of hypotheses, in expecting differences in perception between certain student groups, was criticised on methodology grounds by research reviewers. For reasons associated with the 'newness' of the Newcastle medical school and the power of the Hawthorne effect on its students at that stage of its development, the Newcastle data was not included in the survey. The resultant comparison was between the perceptions of the learning environment in four remaining, traditional medical schools. The original survey design was considerably weakened by the late withdrawal by one other small, but relatively new medical school.

These primary problems are not new to evaluation research, but they appear perennial hazards to appropriate measurement of students' perceptions as potential agents of curricular change. Concerted efforts to minimise the uncertainties created by poor measurement methodology are still no guarantee for clear interpretation of this form of information.

OUTLINE OF SECONDARY INTERPRETATION PROBLEMS

The secondary problems of interpreting student perceptions deserve a more critical review than they are sometimes given.

Accepting students' perceptions at face value for the moment the more immediate secondary problem is to establish post hoc criteria for noting substantial perceptions. This also assumes that the potential value of any perception, as an agent for change, is implicit in its clear statement about the learning environment. Criteria for noting substantial perceptions may relate to statistically significant agreement between students, or differences hypothesised between selected samples (e.g. other students, or staff perceptions). It is awkward, and of doubtful value, to force perceptual data into statistically-determined post hoc criteria when there is a broad range of opinion. That is, what pressure for potential curricular change is afforded by perceptions which collectively show no clear consensus?

This kind of problem faced the Newcastle medical school's programme evaluation committee recently as they reviewed a student-initiated and conducted evaluation project. Students interviewed each other according to a pre-determined set of questions about their perceptions of the Newcastle curriculum and its implementation. Their confidential report was based only on a 25 per cent random sample of students in each Year, and needed some form of criteria for attention by the Faculty. Ultimately, priority on the usefulness or credibility of these data was determined according to whether students' perceptions were consistent across all Years, or at least consistent within a Year and reflecting expected trends across Years, or simply consistent within a Year. Low priority for change was afforded to diverse perceptions within or across Years.

While such a system is still rather subjective, it is inevitable that most attention will presumably be given to perceptions reflecting strong agreement and strong intensity. However this re-introduces the original interpretation problem, relating to the accuracy of students' perceptions.

It is tempting to believe students' perceptions are accurate reflections of their learning environment. These perceptions are even more convincing if there is strong consensus, and in a direction which appeals for change through apparent dissatisfaction with the program. Newcastle medical students evaluate their tutors' behaviour by

rating form as part of their regular end-of-term programme evaluation activities (see Feletti et al, 1982). Analyses of these student perceptions in terms of inter-rater agreement on the same tutor have shown that consensus does not necessarily imply accuracy of perception and that students in the same group often show little consensus about their tutor. Unfortunately, there is no simple method for checking perceptual accuracy unless efforts are made by evaluators to identify concurrent, more objective measures of the students' learning environment. Even this strategy may prove to be fruitless, which leaves the residual problem of deciding what interpretation to put on students' perceptions - other than treating them at face value. If this is the case, then evaluators and students must be resigned to having such data held in low priority for changing the learning environment.

CONCLUSION

In a broader evaluation context the relevance of student perceptions will be gauged in relation to the current environment and sensitivity to change, the representativeness of such data and the personal and financial costs and benefits of implementing change within the given institution. It is debatable whether evaluators can ever hope to overcome the numerous problems in having students' perceptions accepted as legitimate agents for change.

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Long Term Learning: Implications for Teaching and Research

J.P. Powell
University of New South Wales

ABSTRACT

After urging the need for a greatly increased research effort into the enduring effects of education, earlier studies in the United States and some current projects in Sweden are reviewed. Some of the problems facing research workers are outlined and a number of key issues identified. It is suggested that a fuller knowledge of the nature and genesis of the residues of learning will probably lead to major changes in curricula and teaching methods in higher education.

J.P. Powell, B.A.(Bristol), M.A.(Dublin), Ph.D.(ANU) is the director of the Tertiary Education Research Centre at the University of N.S.W. He has taught in a primary school, technical college, the College of the Sea, and at universities in England, Ireland, Canada and Papua New Guinea. He is the author of more than one hundred papers on topics in philosophy of education and higher education. Current interests include adult learning, use of autobiographical methods, teacher planning, professional ethics, and theories of higher education.

Address for Correspondence: Dr. J.P. Powell, Director, T.E.R.C., The University of N.S.W., P.O. Box 1, Kensington 2033 N.S.W.

Introduction

Although immense sums are spent every year on the provision of formal education remarkably little is known about the extent and nature of the long-term residues of what is learnt in schools and universities. It is certain that much of what is learnt is soon forgotten and has no lasting impact on the lives of individual learners. As Bowen (1977) has pointed out:

> "Everyone knows that the half life of memorized details from academic learning is short unless the information is used frequently. What we do not know, and should investigate, is the residue left over from academic learning when the details have been lost. (p. 64)".

Any investigation of this topic poses formidable problems for the research worker and this may explain why it has received so little attention. Our understanding of the processes and activities associated with human learning is poor and thus does not provide a firm base for studies of long-term effects. The field is conceptually confused and theoretically under-developed. Appropriate research designs and methods are difficult to identify. Knowledge, skills, attitudes and values are subject to continual modification as a result of further experience so that it is difficult to link particular characteristics to learning experiences which may have taken place many years earlier. The collection and analysis of data from adults is also very time-consuming and requires the collaboration of many people. Finally, as Harnqvist (1977) has pointed out:

> "In research on this topic, one cannot expect clearcut and indisputable results even if the work is done with craftsmanship and sophistication ... Even so, I think it highly worthwhile to do such research. Indeed it is almost an obligation for some members of the educational research community to devote serious work and attention to the long-term impact of the educational enterprise."

Such an obligation arises from the great theoretical interest and importance of the topic as well as from its possible implications for educational practice. At present decisions about the curriculum, methods of teaching, and the most appropriate milieu for learning rest almost entirely upon untested assumptions and lack any substantial empirical base. We know very little about the relationships between the rhetoric of educational aims, the daily realities of learning, and the long-term effects of educational arrangements. The outcomes of research in this area could be expected to have profound consequences for both the content of what is taught and the ways in which it is learnt.

Earlier Work

Previous studies of the enduring effects of education have generally adopted one of three approaches: surveys of graduates, effects on socio-economic status, and large-scale surveys of the distribution and nature of public knowledge. Most of this work has been undertaken in the United States.

The first approach has generally used questionnaires to seek the opinions of graduates on the impact of their undergraduate experiences. Spaeth and Greeley (1970) surveyed 4868 graduates from 135 institutions. Eighty seven percent said that college had developed their abilities to think and express themselves "greatly" or "somewhat". A major finding was that graduates attached great importance to the intellectual and value goals of higher education but claimed that their college experience in these areas had been disappointing. Other studies of graduates include those conducted by Pace (1974) and Solmon et al. (1977). A related approach has been that of investigating changes in students between enrolment and graduation (e.g. Jacob, 1957): many of these studies have been reviewed by Feldman and Newcomb (1969). Most of this work was concerned with the impact of higher education upon sociopolitical attitudes and values rather than with cognitive development.

Some small-scale investigations have relied on data derived from interviews. Thielens (1977) reports a study of student definitions of academic learning situations

and the impact of teachers. Perry (1970) investigated undergraduate development by means of longitudinal interviewing. Heath (1976) interviewed 60 graduates in their early thirties and concluded "... that graduate and professional education may not have many powerful or diverse maturing effects on large numbers of students".

Mention should also be made of the growing number of studies (e.g. Lin and Plant, 1976; Prosser, 1981) which are concerned with members of a particular professional group and their perceptions of the appropriateness of their undergraduate training. The findings often include useful material related to long-term learning.

The second approach to enduring effects involves examining the relationship between level of educational attainment and achieved socio-economic status. Several studies have shown these two variables to be strongly related but as the results do not throw any light on the nature of what endures they will not be discussed further here.

Finally, there are the very large-scale surveys which relate knowledge to amount of formal education. Hyman et al. (1975) conducted a secondary analysis of 72 national opinion surveys carried out between 1947 and 1974 in the United States. Their results indicate a clear relationship between level of education and extent of factual knowledge:

> "Whether individuals are 65 or 25 they seem to have learned and not forgotten the kinds of bookish facts taught during their schooling, and the skills and inclinations that help them to master current knowledge of the world have also persisted through long years. (p. 49)".

Bowen (1977), after an extensive review of the literature relating to the enduring effects of higher education, concluded as follows:

> "On the average, college education significantly raises the level of knowledge, the intellectual disposition, and the cognitive powers of its students. It produces a large increase in substantive knowledge; moderate increases in verbal skills, intellectual tolerance, aesthetic sensibility, and lifelong cognitive development; and small increases in mathematical skills, rationality, and creativity. These generalizations are based primarily upon studies describing changes in students from the freshman to the senior years or comparing college-educated people with others. Mostly, however, these studies do not reflect the cognitive residue of a college education after the detailed knowledge is forgotten and only the larger principles, ideas, cognitive abilities, and intellectual and artistic interests have survived. (pp. 432-433)".

Some Current Projects in Sweden

Several Swedish researchers are working on the long-term effects of higher education and attempting to relate these to the learning experiences of students. Henrysson and Franke-Wikberg (1980) are investigating ways in which students progressively form stable conceptions of education and professional work. Interviews and questionnaires are being used to collect data from 100 students in four professional faculties. The study is a longitudinal investigation of the extent of the transformation of student concepts and attitudes which occurs during a programme of professional training. It is related to a collaborative effort (the FORM project) by workers in several European countries to examine the impact of higher education through identifying socialization effects (Percy, 1978; Sandberger and Lind, 1979).

Harnqvist and Christianson (1980) are examining educational effects (e.g. cognitive ability, communication skills, social and cultural differences) among various professional groups. In addition to questionnaire and interview data they are following up a national sample of 12,000 people from whom base-line data were collected in 1961 when they were age thirteen.

Two recently completed projects are also relevant to our theme, both being concerned with qualitative changes in student thinking which result from higher education. Hasselgren and Marton (forthcoming) studied how student teachers' apprehensions of

children at play change as a function of their experience of a training programme. A class of 28 students were shown, individually, a videotape of children at play and then asked to say what they recalled of it. This was repeated twice during the training programme and the accounts given by the students constituted the material of the study. Analysis of the data indicated a developmental trend in the accounts which was absent from those given by members of a control group thus suggesting that it is an effect of educational experience. For our purposes the main interest of this project lies in the methods used and the focus upon qualitative changes in students' thinking which can be related to a particular teaching programme.

Dahlgren's (1981) research into the teaching and learning of economics arose from some earlier work of Marton's group at Goteborg which was concerned mainly with strategic differences in the ways in which students approached study tasks. Dahlgren, using interviews and analysis of examination answers, looked at the effect of the study of economics upon the 'naive' economic concepts possessed by students at the beginning of a course. The most striking finding was that over half of the students completed the course without any improvement in their understanding of basic economic ideas. Their ability to pass the examination was attributed to jargon acquisition and mechanical problem-solving capacity. This study is of interest because it indicates the constraints which may be placed upon long-term learning by student characteristics and the use of inappropriate methods of teaching.

The Swedish investigations indicate a growing awareness of the need for empirical results which identify the nature of long-term learning effects and relate them more closely to undergraduate learning experiences. They also tend to give more attention to the content of what is taught and the ways in which this is transformed by methods of presentation and the characteristics of learners.

Implications for Research and Teaching

Research into the long-term effects of education confronts a wide range of conceptual, procedural and analytic problems and issues. The large scale investigations referred to earlier were unable to control for intelligence (Wolfle, 1980) and many rely on the self-reports of graduates, a procedure which is open to criticism. More importantly, their findings do not cast much light upon the detailed structure of the residues of learning and none at all upon why this learning survives when so much is lost. Another difficulty which becomes more acute as the original learning experience becomes more remote in time is that of unambiguously attributing apparent effects to particular learning situations. So many other experiences intervene which extend and transform what was first learnt that great caution is needed in the interpretation of results. It may be that much of what is of enduring significance results from subsequent transformation, through reflection upon learning and other experiences, of the content of what was originally learnt. Reflective activities, rather than working at learning tasks, may prove to be of fundamental importance in creating those residues of learning which act as energizing influences in the lives of individuals. There can be little doubt that non-educational experiences are more potent than many educators tend to acknowledge. There is support for this in the work of Badman et al. (1979) who conducted an eight year longitudinal study of 2000 U.S. males who were first interviewed at age 15. They claim that their findings overwhelmingly support the hypothesis that life-long effects are a product of initial differences in abilities and attitudes rather than of formal education. The most dramatic changes were the result of work experiences.

Some of the key issues which need to be addressed by further research include: the detailed nature of the residues of learning, how their content was acquired, why they persist when so much has been lost, how they relate to the aspirations of teachers, and what role they play in the personal and professional lives of individuals. Some of the work currently being undertaken in Sweden is directed at some of these problems.

Researchers will need to be very open-minded regarding choice of procedures in order to bring a wide range of data to bear upon the problems. When exploring long-term effects the use of personal accounts of learning experiences and the reasons for their enduring significance would appear to be essential. Life history data has been used effectively in other fields (Langness, 1965) and autobiographical methods can

undoubtedly be applied to educational research (Pinar, in press) as well as to teaching (Abbs, 1974; Hettich, 1976; Ingram, 1979).

There is, of course, an immense autobiographical literature which can be explored for relevant insights and information. There is space here for only two examples. R.V. Jones (1979), recalling his headmaster at Alleyn's School, wrote:

> "... he provoked us with a weekly lesson on anything ranging from Greek tragedy to Gothic architecture, with Aristotelian philosophy thrown in. The effect that he had on us by opening cultural windows - because some of us looked through them in the hope of proving him wrong - was out of all proportion to the amount of time that his lessons occupied (pp. 20-30)".

Sir Edward Hale (1964), reflecting on his undergraduate days, said:

> "I remember almost nothing of the factual content of what I learned at Oxford; nevertheless I am quite clear that it was of enormous and enduring value to me in teaching me how to get up a subject, how to think clearly for myself, and how to use language to communicate my thoughts (pp. 16-17)".

Greater understanding of the enduring effects of higher education is likely to have profound consequences for educational practice. When we know much more about the residues of learning we shall be able to compare these with what we hope, as teachers, will stay with students throughout their lives. Major changes in curricula and teaching methods may be indicated by such comparisons and Dahlgren's work suggests that this is quite likely. In order to achieve greater success in helping students to learn the essentials of what we hope to teach we may have to bring about quite fundamental changes to the ways in which university teaching is currently conceived and organised. It must be admitted that conventional practice is based largely on tradition and untested assumptions and lacks any firm basis in relation to what is known about its long-term effects. This is being increasingly recognised as an unsatisfactory situation but it can only be changed when we know a great deal more about what graduates take away with them.

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Chapter 4:

MICROCOMPUTERS IN TEACHING AND LEARNING

The advent of the low cost single chip processor and the subsequent explosive growth of microcomputer technology have led to radical changes in a number of aspects of our world. For example, the impact on business has been considerable and the future promises even more rapid change. To the present, microcomputers have found a restricted place in the education process, their use being principally at the primary and lower secondary levels in such applications as the development of reading and elementary thinking skills. At the tertiary level, to date there has been little systematic use of microcomputers in the teaching/learning process, and only a few enthusiasts have taken advantage of the special features which the microcomputer can provide. All would agree that this situation will change in the near future however, and that the microcomputer, appropriately employed, will radically change the face of teaching and learning in higher education.

This chapter presents four very different aspects of the use of microcomputers in higher education teaching and learning. Firstly, Gelder and Maggs introduce the Professional Authoring Software System (PASS) for microcomputers developed by Bell and Howell for the design of instructional modules. They indicate how PASS can facilitate the development of CAI software, and then move on to consider instructional design issues; in particular, to stress the importance of effective instructional design, and to outline the features of the Direct Instruction model. Their contribution is rounded out with a brief examination of evaluations of the effectiveness of PASS.

The LOGO language, originally conceived in the early 1970's and under continuous development and refinement since has been used with great success in helping children learn. Adams provides a brief history of the development and use of LOGO, then outlines the concept of a programming environment and the unique features of a LOGO learning environment. The great potential that LOGO has for enhancing the teaching/learning process in a number of areas of higher education is then indicated.

Up to the present Computer Assisted Learning (CAL) has had a very restricted application in tertiary education, principally because of the necessity to rely on the ready availability of very high cost large central computer facilities linked to a large number of terminals. Smith indicates that this is no longer the case and that the availability of low cost microcomputers now enables even a department to implement CAL. He describes the establishment of a "personal computer" CAL unit within a department of civil engineering and outlines some of the issues and problems associated with the operation and use of that facility.

As has been the case in education with virtually all "new technology", so too has it been the case with the microcomputer - initial grand visions of the very great enhancement of the teaching/learning process to be provided by the technology have faded to a somewhat lesser and/or different reality. In the final section Bailey provides an insight into this process, describing how initial perceptions of the staff of a physics department on the use of microcomputers in teaching/learning have been modified over a period of a few years of actual use.

Designing Instructional Modules in Training Programs Using Microcomputers: An Interactive Approach ●

A. Gelder and A. Maggs
Macquarie University

ABSTRACT

The Professional Authoring Software System (PASS) for microcomputers developed by Bell and Howell Ltd., greatly facilitates the design of instructional modules for educational and industrial learning. There are four major components to PASS. These are the authoring system which facilitates the development of instructional sequences relevant to specific training objectives; the presentation system by which learners are presented with a fully interactive program involving instruction and testing; a management system which controls enrolment and a reporting system which gives detailed analysis by learner, unit and lesson. Instructional design is a key feature in software development, therefore attention will be given to simple, transformational and complex sequences appropriate to learners. Empirical data evaluating the effectiveness of PASS in training in education and industry in the U.S.A. will be examined.

A. Gelder, B.A.(Hons.)(Syd.) is a Ph.D. candidate in the school of Education at Macquarie University. She is involved in research in the area of instructional design for interactive education programs used in industrial training.

A. Maggs, B.Ed.(U.B.C.), M.A.(Conn.), Ph D.(Macq.) is a Senior Lecturer in the School of Education, Macquarie University. He has previously taught at Port Moresby Teachers College and University of Oregon in Educational Psychology. He has been a consultant to the N.S.W. Higher Education Board and UNESCO. Dr. Maggs is involved in research and development in instructional design for groups ranging from the mentally handicapped to the gifted. He is currently working in instructional design for computer based education.

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Address for Correspondence: Dr. A. Maggs, School of Education, Macquarie University, North Ryde 2113 N.S.W.

INTRODUCTION

The use of computers and electronics to process information of all sorts, pictures, words and numbers,has furthered the expectations of laymen and scientists alike. Since the new technology deals with information it will have a profound influence on education. It will influence how, what and where individual's learn. The new technology will necessarily challenge educators to reassess their roles and responsibilities.

MICROCOMPUTERS IN THE LEARNING ENVIRONMENT

Today, the computer is used in such diverse fields as airline booking, hospital patient monitoring, engineering design, financial analysis and choreography. Therefore, its involvement in the learning environment should not be surprising. The application of microcomputers in learning environments has been twofold. Firstly, the computer is used in Computer Assisted Instruction (CAI) or Computer Assisted Learning (CAL). The computer is programmed to become a teaching tool. It can present material and drill students to ensure adequate practice before testing. Recently, more ingenious applications have been derived involving gaming, simulations and problem solving. In computer managed instruction administrative tasks which often consume valuable teaching time are facilitated by programs designed to organize time tables and student assessment.

Schools throughout Australia now possess microcomputers and are beginning to use them for each of the purposes described above. However, at the same time industrial and commercial concerns faced with vastly expanding information areas and evident knowledge deficiencies which must be overcome, are using microcomputers for in-house training. Information areas within industries tend to be specific and often require constant update. The cost of training both in terms of employment of training personnel and production of materials and loss of working hours is extensive. Computer assisted instruction provides the possibility of individual training, thus allowing training officers to spend more time in areas such as task analysis, and program preparation. However, a difficulty faced by both training departments and teachers alike has been existing courseware. Prepackaged courseware is often irrelevant, thus an inefficient method of instruction. The alternative, specifically designed courseware is exceptionally time consuming therefore limiting the utilization of the microcomputer in the learning environment.

THE PROFESSIONAL AUTHORING SOFTWARE SYSTEM (PASS)

However, the recently developed authoring system (PASS) developed by a team led by Dr Carl Roetter at Bell and Howell, United States, can greatly facilitate the production of software making computer assisted instruction a more viable instructional technology. The system released for Australian application in February, 1982 is specifically intended for use by higher education institutions and industrial and commercial concerns. In the United States, Florida State University and the Education Departments of Alaska and Idaho are using PASS for the development of curriculum materials and for research and evaluation. Companies ranging from General Motors to Standard Oil and Westinghouse are using PASS for the development of specific in-house training programs.

Why does PASS facilitate the development of software?

PASS is an English based authoring system with a great deal of programming flexibility. There is no need for trainers or teachers to become familiar with programming languages such as Fortran, Pascal or even Basic. PASS also has a sophisticated prompting system to guide the designer through the lesson development. The design of PASS followed research by Dr Carl Roetter and his team, seeking to identify and reduce to formula some of the procedures people apply when they learn. The aim of the authoring system was to aid instructors with knowledge of certain subject areas create interactive computer assisted instruction. PASS prompts the instructional specialist through information and questioning sequences. The questioning sequence essential for monitoring student competency has powerful answer judging facilities. Unlike many computer based programs answers can be given as open ended responses rather than simply multiple choice or yes/no responses.

Individualized instruction was the primary concern of early proponents of computer assisted instruction. PASS has facilities to cater for different rates of learning. Students incorrectly answering particular questions can be automatically branched to the information sequences dealing with the area. Alternatively, students can be branched on the basis of concluding criterion-referenced tests, to information sequences, lesson review material or remedial exercises.

PASS also includes an automated grade recording and lesson analysis system providing instant student reports and giving the lesson designer an overview of the effectiveness of the program. Accidental entry into non-appropriate material is eliminated by intricate entry security systems.

PASS is an interactive system, therefore, information sequences determined by the designer can be interspersed with relevant slide, videotape or videodisc material. The videodisc is a dynamic visual media with extensive educational applications, since it has the capacity to integrate slide and film materials.

To summarize, PASS is an authoring system with four essential components. The first, the authoring system has English based authoring, is fully programmable, includes high resolution graphics, uses defineable characters, video interface and powerful answer judging facilities. The presentation system which is the visual program seen by the student includes learner entry validation, automatic data acquisition and carries out branching. The management system controls learner environment, entry security, linear, dynamic, direct and prescriptive branching. The reporting system has the capability to analyse data in terms of learner, unit and lesson.

THE ROLE OF EDUCATIONAL SPECIALISTS IN INSTRUCTIONAL DESIGN FOR MICROCOMPUTERS

While the Professional Authoring Software System is easily programmed, instructional design is still an important issue. The effectiveness of learning by computer assisted instruction is dependent of the design of the program. Errors such as programmed steps which are too elementary, lessons that are boring and feedback that is poorly formulated are likely to occur without the involvement of experienced instructional designers.

Educational and instructional psychologists working within higher education institutions have the background to be effective instructional designers and to teach students in the rudiments of software design. Already in the United States instructional design has been recognized as a legitimate field of study. Attention has been given to reseach in instruction over the last ten years pinpointing the crucial design variables for the most "effective" instructional sequences for a variety of learning situations.

The School of Education at Macquarie University is following this lead. Courses in instructional design are available to undergraduate and postgraduate students. The school also has the use of the Professional Authoring Software System and will be involved in software production, evaluation studies and consultancy on instructional design with industrial and commercial training departments.

BACKGROUND TO INSTRUCTIONAL DESIGN

The application of microcomputer technology in the workplace or the educational system requires a set of defined steps. It is predicted that if electronic media available to instructional designers is to be used effectively they will require a sound knowledge of relevant learning theory and strategies of instruction for specific learners.

During the 1970's instructional design became a legitimate field of study. There was a move to develop instructional design sequences on the basis of established research in both psychology and communications. Andrews and Goodson (1980) have reviewed forty instructional design models formulated over the last ten years, for use in industry, education and the military branches. The review of models by Andrews and Goodson (1980) indicates that rather than diverging instructional design models appear at the most fundamental levels to be converging. This trend allowed the authors to propose a set of fourteen common tasks in model development:-

1. Formulation of broad goals and detailed subgoals stated in observable terms.

2. Development of pretest and posttest matching goals and subgoals.

3. Analysis of goals and subgoals for types of skills/learning required.

4. Sequencing of goals and subgoals to facilitate learning.

5. Characterization of the learner on the basis of age, learning history, aptitudes or disabilities, and estimated attainment of current and prerequisite goals.

6. Formulation of an instructional strategy to match subject matter and learner requirements.

7. Selection of media to implement strategies.

8. Development of courseware based on strategies.

9. Empirical tryout of courseware with the learner population and revision of courseware based on diagnosis.

10. Development of materials and procedures for installing, maintaining and periodically repairing the instructional program.

11. Assessment of need, problem identification, occupational analysis, competence or training requirements.

12. Consideration of alternative solutions to instruction.

13. Formulation of system and environmental descriptions and identification of constraints.

14. Costing of instructional programs.

(Andrews and Goodson, 1980, p.5).

The problem with models examined by Andrews and Goodson (1980) was the lack of detailed information on the procedures of task analysis and sequencing of goals and subgoals. While it was recognized that there was a need for a highly systematic approach many of the:

> "systemic instructional design models described in the literature represent a series of mechanical or linear steps rather than the complex and rigorous analytic and cybernetic process required for effective application of the general systems approach to instructional design."

(Andrews and Goodson, 1980, p.13).

However, Andrews and Goodson (1980) did not include in their examination the Direct Instruction models formulated and evaluated by Becker, Engelmann and Carnine in the United States and Maggs and others in Australia over the last ten years. While the Direct Instruction model basically follows the fourteen tasks listed by Andrews and Goodson (1980), more detailed information on task analysis and sequence of instruction is provided. Theory of Instruction (1982) currently in press, by Engelmann and Carnine provides one of the most specific guidelines for effective instructional design available.

The strength of the Direct Instruction model is that it has been formulated from an analysis of cognitive learning processes in terms of three analyses - behaviour, stimuli and knowledge systems. By considering these analyses to be interrelated and interdependent a model using principles from all three analyses has been constructed in order that cognitive learning might occur more efficiently.

Analysis of Behaviour seeks empirically based principles that tell what is universally true about the way in which the environment influences behaviour for different classes

of learners. It is assumed that the learner has the capacity to learn any quality that is exemplified through examples and the capacity to generalize to new examples on the basis of sameness. Proponents of Direct Instruction assert that if failure occurs attention must be focussed firstly on the sequence of instruction. If the instructional design is proved "faultless" in terms of the logical analysis of communication and knowledge systems - learner attributes may be examined.

Analysis of Communications seeks principles for the logical design of communications that effectively transmit knowledge. These principles allow the description of a range of generalizations that should occur when the learner receives a specific set of examples. The analysis of communication focusses on the way in which examples are the same and how they differ. The aim is to present the least number of examples yet still communicate to the learner the range of the concept, for example "computer" has to be taught so that the learner knows the limits of what is a "computer" and can generalize to include several different forms.

In a simple concept such as "computer" a range of examples is presented and a rule is induced. Complex concepts and advanced learners are best taught through a deductive teaching method, that is, examples are presented following the statement of rules.

Analysis of Knowledge Systems is concerned with logically organizing knowledge so that efficient communications are possible for related knowledge. Attention is given to the components of concepts and prerequisites to learning new concepts so that an integrated program of instruction can be developed. The range and sequencing of examples is dependent on the nature of the concept. This indicates the inter-relationship of analysis of communication and analysis of knowledge systems.

Simple concepts or undimensional concepts such as "red" or "house" or "computer" are communicated by a series of examples that focus on the specific meaning that has been determined for the label. Joining or transformation sequences involve the relationship between basic form concepts. For example, if the learner has mastered the discrimination of "retrieval" and "not retrieval", it is then possible to combine "retrieval" with concepts that are logically unrelated, for example computer program, lost property etc. The way to link "retrieval" and another concept is by a transformation sequence. A transformation is a systematic ordering of examples and a parallel ordering of symbols used to describe the examples.

Complex concepts are characterized by logical requirements. The learner must attend to various dimensions or features of the examples to understand the concept. Two types of complex communications or complex sequencing are cognitive problem solving and communications about events. For problem solving such as how to design a computer program to balance a cheque account, the routine is designed so that the learner produces overt responses for the various communications or details that logically must be processed if the learner is to solve the problem. After the learner has mastered the overt routine the steps are made covert so that the learner processes these steps independently.

Communications about events deal with learning about a new "whole" by learning about unique relationships of the different parts that compose a whole. The object may be an object such as a particular "microcomputer". The goal is not to use the "microcomputer" as an example of some concept that is common to many others but rather to attend to the features that make the particular "microcomputer" unique.

This has been a very basic exposé of the Direct Instruction procedures used to communicate information. A number of such procedures based on analysis of communications and knowledge systems are involved in the production of an integrated program. The intent was to demonstrate the complex operations involved in effective instructional design. The systematic analysis of communications and knowledge systems provides specific guidelines for program development and evaluation.

EVALUATION OF MICROCOMPUTER BASED INSTRUCTION

The aim of proponents of the Direct Instruction model "faultless instruction" has clear implications for evaluation. If the learner does not achieve mastery of the instructional objectives, the instructional sequence has errors. The design sequence is structured so that formative evaluation is built-in. The designer can logically examine the sequence to extract the cause of failure.

The Professional Authoring Software System (PASS) having a detailed reporting system can automatically evaluate programs. Design faults are instantly observable on the basis of learner failure on particular items. The effectiveness of instructional units developed using PASS or in fact any method of computer assisted instruction must be firstly retention and application of information by learners. The second criterion is the time element. Truly effective instruction is maximum learning in minimum time.

An analysis of learning effectiveness using programs developed using the Professional Authority Software System (PASS) was undertaken by Deltak, U.S.A. This company is classified as a producer, that is, they are licenced by Bell and Howell Ltd. to produce software using PASS. The company is also using PASS in Australia for the production of instructional software in facets of computing ranging from systems analysis to management. Deltak evaluated the software and found that the time required for trainees to learn specified concepts was reduced by approximately 30 per cent. This dramatically lessened instruction time, thus reducing costs and freeing teachers and trainers for program development activities. It was also found that students' retention of information significantly increased. The validation for utilization of the system was the mastery of specific skills by all learners. In addition, the automatic student enrolment, record keeping and reporting of results enhanced the overall management of the training program.

The next step in the evaluation process is a more extensive examination of the sequence of instruction and the range of examples used, in computer assisted instruction. As Engelmann and Carnine (1982) realize, the microcomputer can provide a highly standardized presentation medium, ideal for the evaluation of instructional sequences. Therefore, microcomputer based instruction and the Direct Instruction model can feasibly become a highly complementary team in instructional technology in the future.

CONCLUSION

The new technology encompassed by PASS can become a viable, exciting component within educational institutions and industrial and commercial concerns. However, educational institutions have a role to play in the design of instructional materials using software systems such as PASS. The instructional designer will become important as a conceptualizer of materials, as a member of a creative teaching team and as a researcher who will be able to contribute to organized knowledge related to instruction and learning. As La Gow (1979, p.238) acknowledges -

> "media and technology do not flourish simply on the basis of having complicated machines but because creative use is made of the means and resources to improve effective instruction according to the needs of individual learners".

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LOGO in Tertiary Education

C.A. Adams
Royal Melbourne Institute of Technology

ABSTRACT

The development and use of LOGO teaching environments has been proceeding in research and school situations since the early 1970's. In particular the work carried out at M.I.T., and the University of Edinburgh Artificial Intelligence Laboratories has focussed on children in early secondary education. LOGO as an extensible language has many possibilities in tertiary education in areas as diverse as Computer Awareness and logic. In particular the lack of a stereotype mathematical emphasis in the language has advantages where a language such as BASIC would pose a threat to the student. This paper examines the potential of LOGO in tertiary education drawing on the author's own experience and that of overseas workers.

C.A. Adams, ARMIT, Grad.Dip.Man, MACS, MACM, is a Senior Lecturer in the Department of Computing. He has eighteen years experience in various positions in the computer industry, and has been at RMIT for four years. His research interests are in programming languages for learning. Mr. Adams is contributing editor (education) for Australasian Computerworld, and is editor of COM3, a magazine published by the Computer Education Group of Victoria.

Address for Correspondence: C.A. Adams, Department of Computing, R.M.I.T., G.P.O. Box 2476V, Melbourne 3001 Victoria.

INTRODUCTION

LOGO, a computer language developed at Bolt, Beranek and Newman in the period 1966-71 is intended as a medium suitable for teaching children programming. Solomon (1) states "we wanted to create a programming language for educational purposes with special emphasis on making the language easy for elementary children to learn. We figured that if elementary children could use the language, then older beginners could as well". In 1970, Papert one of the creators of LOGO, who drew both on his background as a mathematician, and as a collaborator with Jean Piaget, established the LOGO laboratory at MIT.

The roots of LOGO are in a number of areas, principally in the belief that the list structures of LISP, coupled with its proceduralisation and extendability, form a suitable model for a learners language. To this, was added in the early 1970's, a robot (turtle), which could move around the floor or exist symbolically on a graphics terminal. Finally the lessons learnt in the design of overtly algebraic computer languages such as BASIC and FORTRAN were applied to produce a language with less emphasis on the learners own mathematical background.

A number of papers, such as Papert (1), Watt (2), Wills (3), and a forthcoming text Abelson (24), are good introductions to LOGO.

The period of the 1970's was characterized by LOGO's use as an educational research tool in a small number of institutions, including BBN (Bolt, Beranek and Newman), MIT and the University of Edinburgh.

At BBN, Feurzeig and Lukas (4) used LOGO as a tool for teaching symbolic logic, algebra and for remedial maths. This work was carried out both at elementary school and university level.

At MIT, research was aimed at children between 10-12 and was in Papert's (5) words: "to enhance education with the use of technology". The computer was seen as a tool by which "children could learn how to learn".

The ideas embodied in this research were consistent both with Piagets view of child development (6), and the theories of knowledge current at MIT Artificial Intelligence Laboratory. LISP was developed at MIT, artificial intelligence laboratory.

Research at MIT culminated in the Brookline project (7), in 1978, where a number of mini computers were placed in a local (Boston) elementary school. As with earlier LOGO research, detailed observation was carried out on a small number of students. Researchers noted the progress of individuals, and how the approach differed from student to student. No statistical evaluation was carried out. Papert (5) believes that computer environments may change our ideas of the way children develop, and that therefore current evaluative techniques based on existing theories of development are irrelevant.

At the University of Edinburgh Artificial Intelligence Laboratory, more traditional research work has been proceeding. LOGO has been used as a means of teaching mathematical concepts in the existing curricula. In this work, larger groups of students from a local boys school have been used, and statistical evaluation has been carried out. Ross and Howe (8) summarise this work.

Most of the research at all the above centres has been based on using LOGO as a tool, to learn something else, rather than to learn LOGO or even programming in general. Cannara (9) is one of the few researchers who have undertaken research into how students learn to program using LOGO.

Allison and Edmiston (10) and McDougall and Adams (11) examine in greater detail, both the history of LOGO, and its use in research.

In Australia, the use of LOGO was pioneered by the Elizabeth Computer Centre in Hobart, not for research, but as a vehicle for teaching computer awareness to primary and secondary school children.

The cost of graphics equipment, and the implementation of LOGO only on a small selection of machines, effectively put it out of the research of most teaching establishments, throughout the 70's. This position has now changed with the widespread use of personal microcomputers at all levels of education. Limited versions of LOGO have been available in Australia for the Apple for some time. In addition, full implementations have been written by Texas Instruments for their personal computer and by MIT LOGO lab for the Apple.

Appendix 1, provides some simple examples of LOGO procedures.

COMPUTING IN TERTIARY EDUCATION

Computer languages have a place in many aspects of tertiary study. The following list covers both traditional areas and a number, where computer technology has yet to make a major impact.

Computer Science

The education of professional computer scientists, data processing experts, and computer science teachers.

Programming for Technologists

Technologists, may require a knowledge of programming to carry out problem solving in their own professions (i.e. engineering, physics and accountancy). While accountants may not have to implement computer systems themselves, they are often required to take part in the planning and management of computer projects. Increasingly, engineers and other technologists are making direct use of computers themselves, rather than relying on professional programmers.

Computer Awareness

This includes subjects where a knowledge of computing may be important to a student's development, but where in professional life the student would be unlikely to program a computer directly. School teachers are increasingly required to have a background knowledge of computing.

To Gain Insight into Other Disciplines

This is an area where a computer language may provide insights into the nature of natural language, music, mathematics, etc.

The headings are defined to include areas where the structure of the computer language itself is important in reaching educational objectives. It therefore does not include CAI, since this technique can be used in almost any discipline, or courses which concentrate on the use of specific packages (i.e. statistical and accounting packages), the use of which are becoming increasingly important in all areas of education.

I see the choice of programming language in each of the above areas as a vital aspect of meeting subject objectives. A badly chosen language will at best obscure intentions of the subject by placing an unnecessary obstacle between the student and the subject matter, at worst it may lead to such a level of frustration on the part of student and teacher alike, that objectives become unreachable.

LOGO LEARNING ENVIRONMENTS

Dwyer (23) states that: "education is that which liberates potential and thus the person" and that in this sense it "takes place best in a rich and joyful environment".

Solomon (13) describes a LOGO environment as:

A computer

A programming language and operating system

A collection of computer peripherals, usually including graphics and turtles

A collection of projects

A meta-language - a consistent way of talking about the language, the projects, etc.

A relationship between teacher and learner

A collection of bridge activities such as puzzles, juggling, etc.

This fundamental description of a LOGO environment is supported by a philosophy of learning which sees in the words of Papert (5), "learner as researcher".

Solomon (13) further sees the design of such LOGO environments as having three important facets.

A Procedural View of the World

A procedural view of the world, is one where we can explain processes in terms of the procedures that can be used to describe them. This leads to a view in which processes can be broken down into simpler processes, and these smaller processes can be combined together in various ways.

The Anthropormophic View of the Computer

The concrete nature of the turtle and its movements, allow the programmer to identify and internalise with its actions.

Debugging

Dijkstra (14) has stated that programs should be composed into correctness, not debugged into correctness. While this view may be reasonable in a production programming environment, as far as learning anyway, LOGO educators have taken an alternate view. Solomon (13) states, we learn from our mistakes, that the intricate process of making things work or learning new skills has to do with hypothesizing, testing, revising, etc.

The notions of chasing bugs, producing and explaining unexpected results and of breaking processes down into subprocesses are important in a LOGO environment.

THE CONCEPT OF A PROGRAMMING ENVIRONMENT

The programming language is only one part of the total environment in which a student and teacher must work.

The concept of a programming environment is relatively new in the sense that early batch computer systems could be regarded as uniforming and unfriendly to the user, in particular the user with little or no computer background.

Typically a batch based computer system provided little direct feedback to the user, a long turnaround between job submission and retrieval, and a remoteness from the computer equipment carrying out the tasks.

More recently the development of time sharing systems with on line access, have provided a new view of the requirements to use a system effectively.

Factors considered important in a programming environment are:

A Consistent and Friendly Interface Between the User and the Computer

The reaction of the computer system should be predictable and provide a set of responses to the user, which give a balance of good feedback, and timely and required information, at a level which is both relevant and meaningful.

Input by the user should be in a consistent format and require no more expertise than is necessary to meet the objectives for which the computer system is being used.

Computer Languages Designed for the Task at Hand

The comptuer language or languages being used, should meet the requirements of the task, rather than the task being bent to the requirements of the language. The language should be integrated into the environment. Brady (15) states it this way: "the language you use affects the final solution and the way of attacking the problem. We must be clear about what kind of problem solutions we are trying to encourage".

Hardware Features which Support the Intended Aim of the Environment

For example, graphics displays, good quality keyboards, joysticks and light pens are all examples of such features. Devices, such as the hand held mouse to control a screen cursor, represent current approaches to the problem in the Smalltalk environment (16).

A Set of Tools Should be Available to the User to Assist him in Using the Environment

These may include software/hardware to efficiently write programs, to debug them, to store them, to document work, etc. Languages, text editors, data base systems and word processors, are examples of such tools. The integration of these tools is important for their successful use.

Methodology

A set of rules for accepted practice within the environment to expedite the aim of the environment. Structured programming is an example of such a methodology. Attacking a problem in a series of small steps is part of the methodology of a LOGO environment.

The programming environment should represent a set of tools, in the same sense as a carpenters tools are indespensible to the practice of carpentry.

The study of programming environments has become important in software development. They are considered by authors such as Prentice (17) as being "a way to solve problems of software development such as high costs and hidden errors".

Most large scale computer systems available to higher education, suffer from a lack of integration of the operating environment. Typically facilities are designed for programming use by expert programmers. The CDC Cyber represents such a system, where the user interface to the learner or occasional expert user is quite unfriendly. Many computer systems available to small business, for example the HP250 represent an integrated approach for non experts, but are prohibitively expensive for educational applications.

BASIC, represents an early attempt to provide a learners environment on an interactive basis. BASIC scores well on the first criteria (consistent and friendly), but not on the others. Solomon (13) states of BASIC, "kids who didn't like maths to begin with or who had no introduction to algebra found the commands easy to learn but hard to apply". This is consistent with Brady's previous statement.

The rigid nature of PASCAL syntax and its rich structure, both of which are important aspects in meeting its objective of teaching good programming practice, mitigate against its use in learning situations where this is not the main objective. PASCAL scores well on the second (designed for task) and the fifth criteria (methodology), but not on the others. Some implementations of PASCAL, such as the UCSD version on the Apple II have addressed these problems in terms of a learner environment. The introduction of turtle graphics has provided a LOGO like introduction to programming, and the use of a full screen editor has brought modern "user interface" thinking.

LOGO, represents a currently available language which defines an integrated programming/learning environment at least in implementations that have had their origins at the MIT LOGO laboratory.

LOGO represents only the first such system, Kay's DYNABOOK concept (18), which visualises a powerful computer facility in a hand held book size device, carries the

ideas of a LOGO learning environment, and a programming environment much further. SMALLTALK 80 (16) is a limited realization of this concept and a language (or rather environment) which will become available on 16 bit microprocessors and therefore on a new generation of personal computers. SMALLTALK 80 is not designed as a learners language, and in terms of the next few years will not have an impact on education.

LOGO FOR TERTIARY EDUCATION

No single computer language can be expected to meet the requirements of all areas of tertiary education. An example is PASCAL where its use for computer science education has been an excuse to use it in other areas, for which it is often inappropriate.

COMPUTER SCIENCE EDUCATION

In recent years PASCAL has been the major language taught in introductory computer science subjects. This is so in a wide range of courses where the majority of graduates would be expected to work in commercial environments, where PASCAL is rarely used. The educational philosophy of the RMIT, Department of Computing, is that students will gain an insight into computer science fundamentals via PASCAL, which can then be transferred to the use of other languages. COBOL is used as an introductory language in many data processing courses. The authors experience with adults doing short continuing education courses is that the complex syntax of COBOL obscures the educational objectives (learning to program).

The turtle graphics facilities of UCSD PASCAL provide a model for the brief use of LOGO concepts at the very beginning of computer sicnece teaching, but since increasingly in the future students entering computer science courses will be expected to have some background in computing, this use may be of little value in the long term.

In later years of a computer science course, LOGO provides a suitable vehicle for artificial intelligence and list processing topics. Brady (15) states that "the horrific concrete syntax makes LISP relatively difficult to use". LISP is widely used in research in these topic areas. Since LOGO contains many of the important design features of LISP embedded in a more friendly language, it is reasonable to expect that LOGO would be successful for these topics.

PROGRAMMING IN OTHER TECHNOLOGIES

The profile of many programming subjects in engineering and science degrees, is of an introductory FORTRAN or BASIC subject of one or two semesters in first year. Students are then expected to use this knowledge (mainly of syntax, rather than problem solving) to solve complex design and experimental problems in later years of their courses, without further formal computer education.

Two objectives seem to be mixed up in thse subjects. First, teaching students how to solve problems on a computer, and secondly introducing them to solving problems in their own domains (i.e. engineering, physics, accounting) with a widely used language within that domain (i.e. BASIC, FORTRAN, COBOL). It is little wonder that students learn little, and are unmoved by subjects which are often in batch mode and cover little more than language syntax, how to run programs with an unfriendly operating system, and how to compute well known and understood formulas.

A better model for these subjects would be two tier, with the first concentrating on the problem of learning how to solve problems on a computer, in a computer environment designed for the purpose.

For the reasons stated in the next section, LOGO is a suitable medium (but not the only one) for this. A second tier, then concentrates on solving domain oriented problems, with equipment and languages of the real world (unfriendly operating systems, FORTRAN, etc.).

Regrettably a common view amongst non computer science academics is that anyone who has written a large FORTRAN program (no matter how badly) that computes the correct answer is an expert in computing.

LOGO IN COMPUTER AWARENESS COURSES

Brady (15) summarises the following as important reasons why LOGO is a suitable language for teaching programming to people with no knowledge of computing or numeric mathematics.

1. An interesting problem domain which doesn't rely on students having extensive formula knowledge from some other discipline.
2. An obvious program trace which aids debugging is a primitive measure of efficiency.
3. It encourages the notion of a process as a representation of a solution to a problem.
4. Its primitive commands are simple to understand, being defined purely in terms of actions in the problem and not alterations to the internal state of a machine.

These features are important where students have little mathematical confidence (or knowledge) and where it is vital that if students are to gain confidence quickly, they are motivated by an interesting problem domain, and an easy to use environment.

LOGO, AS A TOOL FOR GAINING INSIGHT INTO OTHER DISCIPLINES

LOGO has been used to teach mathematics at the primary, secondary and tertiary area Hall (20). Typical of this work is that of Feurzeig and Lukas (4) who used LOGO to teach a group of undergraduate students at the University of Massachusetts. These students were regarded as being unable to pass the first year mathematics course.

LOGO has been used in a number of non mathematical areas such as language. Sharples (21), used LOGO as an aid to generating poetry. In this research he made use of list processing features of the language to develop a number of poetic forms.

Lawler (22), has made use of the word processing features of the text editor within the LOGO environment to encourage creative writing.

The first instance demonstrates the use of non mathematical constructions within LOGO (lists) to process language. While it would be possible to do this work in other computer languages such as BASIC, LOGO provides primitive commands to process single characters or characters grouped as words or words grouped as sentences. The solution expressed in LOGO closely resembles the structure of the problem.

The second example demonstrates the use of a user environment. Here a student already familiar with LOGO, and the program editor within the environment, uses the same editor in a word processing situation. The word processor providing power in terms of creating and editing text and in producing printed copy.

Dynaturtle, is an example of a special screen turtle that obeys the Newtonian laws of motion. Rather than simply moving in a direction, it can be "kicked", and responds accordingly. Thus physics concepts are introduced into a general purpose programming environment.

Abelson and Dissessa (24), have developed an advanced geometry curriculum suitable for tertiary mathematics courses, which is based on the ideas of turtle geometry. LOGO is used as a language to describe the geometry in both two and three dimensional space.

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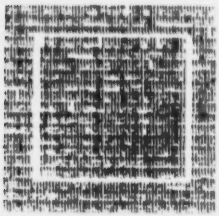
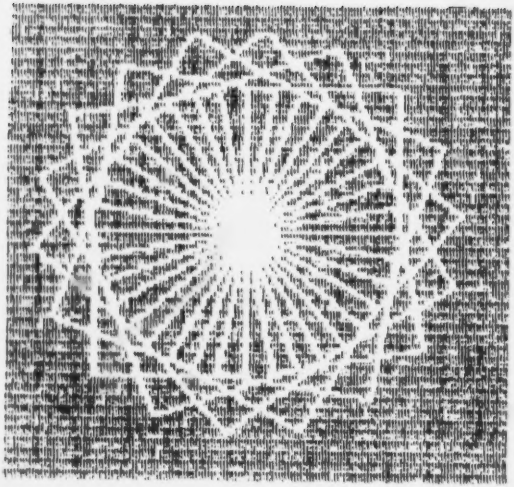
APPENDIX 1

EXAMPLES OF LOGO PROCEDURES

```
To SQUARE :SIZE
REPEAT 4[FORWARD :SIZE RIGHT 90]
END
TO FAN
REPEAT 18[SQUARE 50 RIGHT 20]
END
```



SQUARE 50



FAN

```
TO PRETTYPRINT :MESSAGE
IF FIRST :MESSAGE=[] THEN STOP
PRINT FIRST :MESSAGE
PRETTYPRINT :BUTFIRST :MESSAGE
END
```

```
PRETTYPRINT [THIS IS A LIST]
THIS IS A LIST
IS A LIST
A LIST
LIST
```

Use of Personal Computers for Computer Assisted Learning in Engineering

Geoffrey W. Smith
Chisholm Institute of Technology

ABSTRACT

The advent of the low cost personal computer has resulted in an ability to extend the application of computer assisted learning (CAL) in tertiary education. Teaching departments no longer need be totally dependent on a centralised computer facility. CAL can be implemented within a department, by that department at relatively low cost using personal computers.

The paper describes the establishment of a CAL unit in the Civil Engineering Department at Chisholm based on the use of personal computers. The unit is currently under development and uses programs written by teaching staff of the Department. Some of the programs use a game approach as a means of motivating students, and the addictive nature of computer games ensures that the programs are heavily used by students and also doubles the number of students able to use a given number of computers.

The paper discusses the factors leading to the decision to establish the unit. It will also consider the selection of personal computers for CAL purposes, and the problems associated with obtaining or writing quality learning software for use at tertiary level.

Geoff Smith B.E., Dip.E.C., M.Eng.Sc., M.I.E.Aust., has been a lecturer at Chisholm Institute of Technology (formerly Caulfield Institute of Technology) since 1971. His main teaching field is structural analysis and design. He graduated from Melbourne University in 1959, returning in 1973 to obtain a master's degree. Prior to joining Chisholm he had extensive experience with structural consultants and contractors.

His current interests are the establishment of a CAL unit within the Engineering School, and the teaching of qualitative understanding of structures. He is the author of several papers on these topics. He has also devised teaching systems for structural engineering which are currently being used in Australia and overseas.

Address for Correspondence: Mr. G.W. Smith, Dept. of Civil Engineering, Chilsholm Institute of Technology, 900 Dandenong Road, Caulfield East 3145 Victoria.

INTRODUCTION

The Department of Civil Engineering, Chisholm Institute of Technology, (formerly Caulfield Institute of Technology) has, for many years, placed a significant emphasis on the use of computers by undergraduate students. From the first year of the Degree course, students are involved in writing programs and in using packages mounted on the central computer. Since, in addition, staff of the department have conducted many computer based short courses for practising engineers it was only natural that staff should consider computers as a means of augmenting the teaching methods currently in use within the department. During late 1979 two Apple II personal computers were purchased for evaluative studies. This initial purchase was latter followed by others and has led to the development of a CAL unit based on the use of personal computers.

This paper discusses the factors leading to the establishment of the CAL unit with particular reference to the selection of hardware. Mention is also made of the problems associated with writing quality learning software for use in a CAL unit for use at tertiary level.

It should be stated at this stage that the unit is still under development, so that the paper makes only superficial reference to the evaluation of the effectiveness to the CAL approach. Because of the need to develop software, implementation of the learning programs is a continuous task and it is estimated that it will take at least a further two years before the unit is fully operational.

CAL IN ENGINEERING

Engineers, particularly those practising structural engineering, are heavily dependent on the use of computers and have done much pioneering work on aspects of software development. Consequently the use of computers in undergraduate engineering courses is well established. Most of the computing performed by students falls into either of two categories:

1. learning computer languages and skills,
2. using package programs for analysis and design.

Neither of these categories are direct applications of CAL which can be defined loosely as learning which occurs by interaction between a student and a computer: In an engineering context CAL may be classified as one of:

1. Directed use of package analysis and design programs.
2. Instructional dialogue (question and answer) programs.
3. Guided problem solving tutorial programs.

Commercial package analysis and design programs, in general, have been written with no thought whatsoever given to student learning. They have commercial objectives in mind and are structured accordingly. Students must become familiar with the use of such packages in preparation for their future careers. However these programs can be used for learning as students can perform sensitivity studies (what happens if ----) to gain a knowledge of structural behaviour. The successful learning use of a commercial package in this manner is described by Brohn (1980). This approach has also been used at Chisholm.

A somewhat different approach is employed by the computer program "CAL" (Computer Analysis Language) by Wilson (1977) which consisits of a high level Problem Orientated Language (POL) in which each command enables a major step in the analysis of a structure to be completed.

Instructional dialogue programs do not have a wide application in professional engineering education where the major emphasis is on synthesis rather than acquisition of knowledge. The major advantage of this type of program is that it is relatively easy to program as the structure is linear with only minor reentrant branches. Programs of this type have been written for use at Chisholm, and they do serve a definate purpose. However the user life (the period the program is useful for a given student) is limited to short term use for acquisition of certain knowledge and for subsequent revision.

A variation on these first two types of program is described by Townsend and Wood (1978), where a question and answer approach has been effectively combined with an analysis program. Students define their own problem which is then analysed by the computer to provide answers to questions which are later posed in the second half of the CAL exercise. A similar approach is adopted by Bigelow and Lubkin (1979) in their work on reactions and truss member forces.

Guided problem solving tutorial programs are dynamic in their approach and are the major thrust of the program developments at Chisholm. As Huntington (1979) points out, these are harder to program but have a greater probability of success. Being of a cognitive nature, these programs require that students remember things and think through various processes during a process of synthesis. Due to the difficulties in writing alternative approach multi branching programs, software of this type is not readily available. This lack of availability is particularly true in the engineering field.

In summary, the three computer based approaches listed, and other variations, can validly be classified as applications of CAL. However the approach which constitutes the major thrust of this paper is that of the guided problem solving type.

REASONS FOR FORMING A CAL UNIT

The requirements of the engineering profession are such that graduates must display a high degree of proficiency in the performance of certain tasks. These tasks demand that the student uses certain basic knowledge and makes decisions in the process of doing analysis and design tasks. The process is analogous to a steeplechase. Basic knowledge is the qualifying requirement, the jumps are the all important engineering decisions and the track between hurdles is the performance of certain mathematical operations. The aspect of major importance in the teaching of engineering is the decision making whilst the time consuming element is the mathematical operations.

As in a steeplechase, where there are differing types of jumps, the decisions to be made in design and analysis require different judgemental skills. The design and analysis course however, is not as well defined as the running track and the path to the end post is not always visible at the start.

It is evident that time spent on problems where the primary aim is to give experience in decision making will be diluted by the time spent on the mathematical content. It is of course assumed that the student is proficient in these mathematical skills.

The use of CAL in a guided tutorial mode presents a means by which the trackwork (the mathematics) can be compressed so that for a given time increment the student is required to face more jumps (decisions). Although it presents a difficult programming task, CAL programs of this nature can allow a choice of design approach within predetermined limits and ensure that a satisfactory conclusion to a given problem is always reached. Problems, graded in degree of difficulty, can be made available to the student so that he or she can gain confidence on the basis of past success. This ability to enable the student to tackle a much wider range of problems is the major factor influencing the adoption of CAL at Chisholm.

Another benefit of CAL is the teaching of qualitative understanding. Qualitative skills are becoming increasingly necessary due to the use of computers. Answers given by computers cannot be assumed to be correct. The Engineer must ensure that the answers are correct and accept legal responsibility of their validity. Qualitative skills enable a check to be made on computer output. These skills are largely a by-product of experience, and one means of engendering this ability is to engage the student in repetitive exercises. Smith (1980) describes some non-computer based methods of providing these exercises. The computer is also a powerful means of providing repetitive experience building problems and so another objective of the CAL unit is to teach qualitative understanding of structures.

Another reason for introducing CAL relates to the widespread reduction of funding of tertiary education. The effect of this trend will be reflected in increased class sizes particularly during tutorial sessions. The amount of time that a student, particularly one of marginal ability, will have in personal contact with staff will be

reduced. Faced with the inevitability of this trend the Department elected to consider CAL as a means of compensating for increased class size and in particular as a means of supplementing the controlled work of a weaker student. There was no intention that the CAL programs would substitute for lectures or tutorials: the role was to be supplementary. However the ability to offer virtually unlimited access to a computer based learning unit, coupled with the students preference for that learning medium led to the decision to investigate CAL methods, and ultimately to the formation of a CAL unit.

REQUIREMENTS OF THE HOST SYSTEM

This section considers the requirements which were formulated to ensure that the host system would meet the functions of the CAL unit. As a result of preliminary studies, the Apple II microcomputer was adopted as the base computing system for the unit. The requirements of the system which led to this choice are listed in approximate order of importance then discussed.

The system must:

1. Be free of operating system changes.
2. Be available at times to suit timetables.
3. Be devoid of computer mystique.
4. Have large incore memory capacity.
5. Be cheap to purchase and maintain.
6. Be reliable.
7. Have a graphics capability.
8. Be able to support a range of software.

The system should:

9. Be under the control of the teaching department.
10. Be versatile.
11. Have a colour option.

Much of the discussion that follows in this section presupposes that the decision had been made to write the software used in the unit. The need to write software was apparent as initial surveys indicated that there was virtually no programs of the type required readily available.

Each of the system requirements will now be examined.

1. Operating-System Changes

As mentioned in the introduction, the Department had, for many years, been major users of package analysis and design programs on mainframe or mini-systems. In the period 1974 to 1980 the packages were mounted either simultaneously or successively on ICL, Data General Nova and Eclipse or Prime Systems as new equipment was purchased. In addition to equipment changes there was a succession of changes to operating systems and to Computer Centre rules concerning available core memory, lines of printout etc. While it is the proper role of a Computer Centre to ensure that the system under their control is periodically enhanced to offer the best facility to general users at any point in time, there is a conflict with those users who wish to work on a system they understand and to get answers to given problems. It is counterproductive for many users to be faced with the constant problem of mastering a new system and operating rules.

Staff of the Department were all too familiar with the frustrations of maintaining

a suite of programs in order to have them available for student use. The Computer Centre action in constantly updating a system, is very much at variance with the needs of a CAL Unit. In CAL, students are preoccupied with a particular topic and system considerations must not hinder use of the learning packages.

It was considered that in planning the CAL Unit, the host system should remain unchanged for at least five years. It is not reasonable to expect a Computer Centre to give assurances that no changes would take place on that time scale.

2. Suit Timetable

The function of the unit is to supplement tutorial classes. As such, the system must be available at specific times and the lecturer had to be sure that he could access the system at that time and for a given duration. Any teaching aid, be it overhead projector or computer, will only be used by staff if they can be sure of unhindered use of that aid for the scheduled time periods.

This guaranteed access to the system was seen as a very important factor in the decision to act independently of the centralised computer system.

3. Devoid of Computer Mystique

This requirement is partly related to the operating system. It was required that the system used in the CAL unit should make minimum use of log-in procedures, passwords and other similar necessities often encountered with larger computers. The objective was that the units should be available on a simple "switch on, use, switch-off", user friendly basis. The achievement of this aim would encourage computer shy students to use the system.

4. Memory Capacity

It was envisaged that the programs used would require large amounts of memory space, primarily to store the actual statements of the programs. In addition it was decided as a policy that external storage devices, disks and tapes, should not be accessed during the running of a given program. To do so would slow execution and increase the risk of equipment damage and program crashes.

Based on an estimate of 12K each for program and system, 8K for graphics and 4K for incidentals, a memory capacity of at least 36K bytes seemed necessary. The Apples adopted have 48K byte memories.

5. Cheap to Purchase and Maintain

Multiple units were essential, and in order to be purchased from the limited resources of the Department, low initial cost was of prime importance. When discussing the possibility of a purchase of cheap personal computers, fears were expressed by computer purists as to the in service performance and life of the units. It was considered essential to allay these fears before embarking on a major purchase program.

Two Apples were purchased for evaluative studies. Students were given unrestricted use of these units, and whilst abusive use was not encouraged, it was not actively discouraged. The units performed well, and likely annual maintenance costs were estimated to be of the order of 2.5% of the purchase cost: a very low and acceptable figure.

6. Reliability

Reliability has two aspects: hardware and software. The hardware must be free from any feature which would disrupt the running of a program. It must be insensitive to its operating environment and not break execution for reasons other than a major power failure. The dialect of the BASIC language used must be powerful enough to enable the programs to be written in a virtually crash proof manner.

7. Graphics Capability

Engineers communicate graphically. An ability to solve problems graphically using the computer was deemed to be imperative. The centralised computer system was not able to offer any graphics other than unacceptable low resolution character plotting. On the other hand, the dot matrix display of Apple high resolution graphics was of an acceptable standard.

8. Software Support

Although most of the software was to be written within the Department, it was essential that the system should be able to support software written elsewhere if and when suitable programs become available. With this in mind, the minimum requirement for a personal computer is an ability to support the CP/M operating system.

9. Control by the Teaching Department

If a relatively large investment in both time and money is to be made on a teaching system, and if a reasonable portion of student contact time is to be spent using that medium, then control of that system should remain with the teaching Department. It is only in so doing that plans can be confidently made to use the unit and that requirements previously listed can be met.

10. Versatile

The full implementation of the CAL unit was expected to take up to three years. During that period, it was planned to optimise the use of the computers by applications in laboratory work, research and other areas. To do so meant that the units should be compatible with a range of peripheral devices, printers, plotters and data acquisition devices. In addition it was preferred that the system be mobile. This mobility would enable the units to be taken to a classroom and used in a teaching or demonstration role.

11. Colour

It was considered that better visual impact would be obtained using colour. In practice, the limitations associated with high resolution colour graphics has resulted in little use being made of colour.

CHOICE OF SYSTEM AND IMPLEMENTATION

A major problem is associated with the choice of microcomputers and ancillary equipment. In an area of rapidly developing technology, one can be sure that no matter what choice is made, a superior option will become available within a relatively short period of time. At the time of selection of a personal computer for use in the unit, the Apple II system was comparable to other alternatives except for its graphics capabilities which were superior. This was the most significant factor in the decision to adopt that system.

The decision to use personal computers rather than a centralised system was based on several factors. Assurances could not be obtained that the centralised system would be available to suit scheduled class times, or that sufficient memory capacity could be provided for CAL purposes. In addition there was no simple means by which that system could be made user friendly or that the system would remain static over a five year planning period. The personal computer offered all those benefits and allowed the CAL unit to be totally under the control of the Department.

The Apple system, and indeed most personal computers, can be configured to make system requirements transparent to the user. Students using the CAL unit can access the programs very simply. They need only switch on the computer at the mains and then follow simple instructions displayed on the VDU. These instructions can be followed using single key responses: typing skills are not necessary. A student with no prior computer experience is able to use the programs without fear.

The 48K memory of the Apple is sufficient to accommodate large programs and also the significant amount of data necessary to run the programs. With this capacity, data for many problems can be contained within memory; no disk access is necessary. The vast amount of data has posed some problems but these have been solved using composite numbers and discrete use of machine language programming.

The low purchase price of the personal computer has enabled multiple units to be purchased from the limited resources of the Department. At this point in time a target of 16 work stations has not been achieved. Some programs have been written in games format which encourages use of one computer by two students and so maximises the exposure students can gain to the programs during the implementation phase. This games approach as described by Smith (1981) not only doubles up on the use of computers but also is an effective motivational incentive to learning.

The Apple System has proved very reliable in use and actual maintenance and repair costs are less than half the estimated figures. In addition to use for CAL, the Apples have been used to teach programming to undergraduates and also for short courses for practising engineers. In the writing of programs special attention has been paid to interactive input statements. Normal INPUT or GET statements are not used. Instead special routines check input validity and eliminate program crashes due to incorrect data type. In this manner, program reliability is written into the software.

Wide use has been made of the graphics, which although rather coarse, is adequate for teaching purposes. The programming requirements to mix graphics and text are one major disadvantage of the Apple system. Very little use has been made of colour mainly because of the poor resolution of colour in the graphics mode.

During the period in which the CAL unit is being implemented the Apples are being used for other roles, some of which have been mentioned. The portability of the units allows them to be used during lectures for teaching purposes. Simple programs can be used for dynamic demonstrations of certain principle being taught at the time. The system is also used extensively for research and investigation work and design and analysis programs have also been implemented.

Although the Apple has proved very satisfactory for use in CAL, other systems are also being investigated to ensure that future purchases are wisely made. An Atari 800 computer has recently been obtained for evaluative studies. Difficulties associated with software transfer between personal computers are a major problem, and must be given serious thought when considering any change in the base system.

CONCLUSIONS

This paper has described the factors leading up to the decision to form a CAL unit for engineering students. The system requirements have been outlined and factors associated with implementation discussed. At this stage, insufficient use has been made of the unit to be able to offer any worthwhile comment on the effectiveness of the teaching programs. The use of the learning programs however has proved very popular with students and the author has no doubt that this in itself will contribute to the success of the unit.

As one would expect, the writing of software is a time consuming laborious process. Not only does the learning program have to be written but the volumes of data dictates that data creation programs be written concurrently to expedite the formation of the data on which the programs operate. Much has been learnt on the techniques of producing these learning programs in order to provide multiple approach exercises. The greatest need in order to maximise the effect of the programs is a consideration of psychology of learning aspects associated with the use of microcomputers. Such matters as how to optimise the use of colour, delays, flashing and other system facilities must be determined and incorporated in future programs.

On the basis of the work carried out so far at Chisholm it is concluded the microcomputers are an economical and effective means of providing CAL for engineering students.

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A Monte-Carlo Approach to the Use of Computers in the Teaching of Tertiary Physics

D. Bailey
N.S.W. Institute of Technology

ABSTRACT

Several years ago the Physics Department investigated the idea of introducing computers into the teaching program of the Department. With some great enthusiasm it was decided to purchase an APPLE II for use within the Department. Having seen the machines doing marvellous things we were convinced that our students would benefit greatly and that there would be many things we could do to enhance our teaching program.

Where are we, now, two years later?

The answer to this is that we have found many uses for our machine that we never really considered as important when we purchased the first APPLE. Of more significance to a group, such as HERDSA is, is that many of our initial ideas were very naive in retrospect despite some considerable reading and experimentation before we bought the hardware.

This paper describes how the APPLE has been used in the Physics Department and where we are now aiming to go having decided to purcase a second APPLE.

D. Bailey M.Sc. (W.A.), Dip.Ed. (K.C.A.E.), G.A.I.P., M.A.C.E., graduated from the University of W.A. in 1964 and spent three years at the University of N.S.W. before joining the Institute of Technology in 1967 as a Lecturer in Physics. He has spent one twelve month period of study leave in the U.K. at Harwell and Bristol University (1974-75) and a further period of six months Professional Experience Program working at the A.W.A. Microelectronics Division at Rydalmere.

His research interests are in the fields of Crystallography, Physics Education, Computing and Electronics.

Address for Correspondence: D. Bailey, Dept. of Physics, N.S.W. Institute of Technology, P.O. Box 123 Broadway N.S.W. 2007.

INTRODUCTION

The department of Physics at the N.S.W. Institute of Technology has a policy of presenting to their students a course which is deliberately designed to produce graduates "who are not only good applied physicists but are of immediate use to industry". The design and implementation of a course to achieve this goal is not achieved overnight nor is the way it is organised a static process. The result is that the teaching staff are continually examining & reviewing the overall program, the inter-relation of the teaching units, the syllabus content, the laboratory program and the way in which the students are taught.

It has become increasingly obvious that a graduate in an applied physics course should be as fluent as possible with both electronics and computing as well as having a traditional education in aspects of solid state physics and other branches of physics met in most degree courses. The number of authors drawing the attention of the public to the future problems of a society is large (Toffler (1972), Clarke (1962), Large (1980) to name just a few) and physics as much as any other discipline is deeply involved with the design, introduction and implementation of the new technology. Furthermore as educators we have also to consider not only "what" but also "how" we teach our students in preparation for their future careers. Aspects of this have been examined by various authors (Toffler,1974) but we certainly cannot teach about the impact, design and use of computers unless we physically expose our students to them.

The impact of the microcomputer on teaching, plus its special relevance as an example of microelectronics and computing, led to the Physics department deciding in 1980 to purchase an Apple II microcomputer. The original proposal was unanimously supported at Committee, Department and School level. As a result of this support and because of the usual financial problems of restricted budgets giving "once only" opportunities to buy peripherals, the initial investment included not only the Apple and a single disk drive but also a Dot-Matrix Graphics Printer(the IDS 440 Paper Tiger), a light pen, a Graphics Tablet, the Heuristic Speechlink, Mountain Hardware Supertalker plus Sandy's Word Processor Package. The provision of a Pascal Language card gave us the option of either Applesoft Basic or of Pascal as programming languages. The equipment arrived in July 1980.

The decision to go with the microcomputer was made after a six monthly trial with a borrowed Apple. A project student, A. Walsh (1979), assisted by workingt on a program for tutorial problem solution. The Apple was specifically selected for its colour graphics capability which at that time was not available from any of the other brands in the same price range.

THE USE OF MICROCOMPUTERS IN TEACHING PHYSICS

There are many ways microcomputers can be used in the teaching if Physics. Sparkes (1981) cites four areas, namely data acquisition (the collection storage and later display of laboratory measurements), simulation of physical phenomena, computer aided learning and record keeping. This division ignores other aspects which include broader issues of technological awareness & competence plus preparation for future shock (Large (1980), Toffler (1970), Toffler (1974)). It also ignores the importance computer literacy has in the traininmg of a Physicist and that the computer itself may be under the microscope as a field of study in a very "hands on" situation.

THE N.S.W. INSTITUTE OF TECHNOLOGY EXPERIENCE

When the Physics Department purchased its first Apple there were a number of expectations. It was expected that the machine and the students were going to come together and that there would be interaction at the computer aided instruction level. It was expected that research students and higher stage students would use it for number crunching where hand calculators were inappropriate or where a main-frame computer was not accessible. It was anticipated that special "elegant" effects could be achieved through the use of the light pen and the voice reproduction facility. The computer was also seen as an aid to be taken into the classroom to demonstrate topics within the syllabus "as appropriate".

The two major hurdles that were met were;

(a) Student Access:- with highly portable equipment, worth thousands of dollars, student access could not be arranged at a place where appropriate supervision could be maintained. It is hoped that this will be overcome in a variety of ways in the near future.

(i) by the use of V.D.U.s and remote terminals linked to the apple which may be elsewhere in the building.

(ii) by using the apple as a base for developing a program which can be transferred to the Institute's Honeywell system where students can have access to the terminals for a large proportion of each day.

(iii) by supplying students with diskettes with programmes on them which they take at predetermined times of the day to laboratories where the Apples are available under supervision.

(iv) by making our own machines available in the laboratories.

One of the major obstacles to the use of CAI is that it works best on a one to one basis which either limits student access (in our case to a fortunate few) or impels us to provide multiple terminals for student use. (A cost factor beyond the budgets available).

If our machines are in the laboratory then individual students have to be restricted in the amount of time they monopolise the keyboard. The infinite patience of the machine, which makes it so powerful as a remedial tool in the primary school with slow learners and dyslexic children (Little,1981), is not the required performance criterion. At the tertiary level any student needing that type of help is probably far better off seeking the help of their tutor or lecturer.

(b) Software:- The provision of software was considered but somewhat optimistically. C.A.I. as was then envisaged is a monster and I venture to echo others in claiming it to be completely in appropriate to the teaching of any tertiary subject. The software preparation requires both expertise and time - vast amounts of time. The provision of teaching programmes using C.A.I. as another form of programmed instruction is wasteful of staff time and certainly of dubious cost effectiveness when compared with the student using his text book, lecture notes and any tutorial problem booklets produced by the department. This surely we would expect to be within the ability of a tertiary student.

Computer managed insruction or learning, CMI and CML respectively, is a different matter and much excellent work can and will be done in this area.

In the initial stages efforts were made to develop CAI packages to teach specific topics but their exposure to students was almost zero due to:-

(i) Specific topics are only of urgent importance to the student for a few weeks each semester.
(ii) Student exposure was limited to a small period of time when the author could bring the machine to the students or vice versa.
(iii) The students were hesitant about using the machine due to its novelty.
(iv) Only the author and one project student were specifically concerned with writing software for this purpose so the amount available for student use was limited.
(v) Staff interest and awareness was also limited due to a general unfamiliarity with microcomputers plus limited time available to get involved due to other teaching, administrative and research activities.

The result is that what looked like a good investment in up-to-date technology and modern teaching methods could well have been a great disaster with apathy and inertia leaving the equipment idle and unused, plus a growing reluctance on the part of the staff to believe that microcomputers could have a place as a teaching aid. The machine could also have been seen as "belonging" to one member of staff and not the area of responsibility of any one else. A situation observed in some high schools where the school purchases an Apple and one person or department (usually maths or science) presumes/assumes exclusive control and limits its use and availability to the rest of the school with consequent hostility and disinterest by the other teaching staff.

This doom and gloom however is not what I wish to talk about except that it should be recognised and understood, by any organisation purchasing these machines, that the manufacturers claims should be looked at realistically in terms of time and results. Time to get programs "up and working" and results from the point of view of effectiveness as a teaching aid in opposition to the traditional methods.

If I'm not concerned at the picture presented previously then what is the situation ?

Putting a microcomputer such as an Apple into a Physics Department is like letting schoolchildren loose in a sweet shop. The Apple has been increasingly used ever since its installation. Higher stage students immediately used it for numerical analysis of experimental data. Masters research students have used it for developing models of systems they have been working on in the areas of Solar Air Conditioning and Selective Surfaces. One of the technical staff (J. GERTNER), over a period of six to twelve months, wrote a very elegant programme for recording and handling of all stage I and II student records - results from class tests, practical assessments and final examinations. A program which saves approximately two and a half days of record handling work at the end of each semester when deadlines are tight.

There have been a number of simulation programmes written to demonstrate such diverse topics as the diffraction and interference patterns of light from single and double slits (a program which has been incorporated into a set of programmes put out by the Computers Centre of the Sydney Teachers College in 1981) and the representation of molecules within Unit Cells and their rotation in the field of Crystallography. Programs to demonstrate projectile trajectories have been used, in the teaching programme, with the students being interested, not just to hit a randomly positioned target by selecting the projectile speed and angle, but also to hit the target "first go" by calculating from the given x,y coordinates the required speed at a given angle.

Other allied programs allow a student to give to the computer data about a triple loop circuit and then step by step to follow through the solution of the circuit by either(or both) Kirchhoff's laws or thevenin's theorem. A program was written by another project student (Pearson, 1980) to present 4 batches of 10 multiple choice questions to students and to keep track of their score. An aural response was incorporated into this program.

The Research/Teaching program has also been enhanced with programmes written to display X-ray powder diffraction profile data for examination using the graphics capability and to produce relative X-ray intensity data for students to examine the effects of altering fractional atomic coordinates within a unit cell for Spinel structures.

Following the publication by Cornish (1981) of an application of microcomputers to take the drudgery out of tutorials, a program was written to produce data for analysis in a subject called " Experimental Methods ". Here each student is given a set of data which over a period of three weeks has to be examined and analysed by a variety of methods. The set of data is randomised within limits so that every student has data which is his alone. Student collaboration is then permissible and even encouraged since no two students will get the same answer. The staff member has access to the students data, and the answers that the student should get, via the apple. Thus the apple provides not only the data generation but the analysis and the expected answers.

With the Institute purchasing more and more of these machines and the students coming to us having met the machines before at highschool level the problem of access and familiarity are becoming less of a problem compared with the provision of genuinely worthwhile material to present via the media of the computer. The conceptual work is being done now to develop ways to get genuine interactive programmes operational which are broad spectrum in approach rather than focussed on one particular problem from the library of several thousand available. We also wish to be able to offer remedial problems with altered data for situations where the student demonstrates difficulty. At this stage development is starting on the provision of a bank of questions for class test purposes.

The most significant use of the Apple has been in two other areas. The first of these is as a word-processor. Since a better quality Daisy Wheel Printer has been attached to our Apple, several Masters' Theses, two Project Student Reports and numerous different papers and articles have been set up on the word processor. The uses are continually expanding as students,academics and support staff are becoming aware of the nature of the product.

Linked with this is what should be called computer literacy of the staff and students. The Apple is now an accepted part of the facilities of the department with most staff accepting that it is a tool there to be used and that they can use it themselves. The result is that since a second Apple was purchased in late 1981, both machines are occupied for a large proportion of each working day and staff are actively encouraging students to use the machine for the typing of reports - a process which will go a long way towards reduction of the unfamiliarity between our students and microcomputers.

The Scientific Instrumentation side of The Applied Physics Degree Course has had an element of computing in it from its initial implementation but the use of non-specialist machines such as the Apple is to be developed this year with the purchase of two Apples and interface cards to enable the control and data collection using micro computers to be extended further. We were fortunate to hear, in late 1980, from Dr. R. Dalgleish of U.N.S.W., some of the applications of Apples that the Physics Department at U.N.S.W. had incorporated into the teaching program at that stage. Our response has so far been limited by time and money but this will change in the near future.

A further two Apples are being purchased for activities more closely allied to research rather than straight teaching applications. The bank of expertise within the department is growing rapidly and with more machines available they are going to find more and more uses. In this regard the claim can be made, that, even if the initial purchase was over optimistic and even if the applications are not what was intended the results have been that the department has now a much greater competence and awareness of the applications and techniques available. From here we have a chance of achieving goals which can be set from experience and not optimism and we can draw on the skills not of one or two individuals but from the majority of the staff members.

In the total society, implementation of our present technology is slower than expected due to inertia. The technological frontiers are being pushed back faster than we can follow them. It is hoped that our students will not hold back due to unfamiliarity, ignorance or fear.

CONCLUSION

This paper has been written as a documentation that "whilst the best laid plans of mice and man" may go astray sometimes the nett result may be of greater benefit than ever expected. When commenced it was intended that a warning should be sounded to any groups intending to introduce microcomputers as teaching aids, to take stock not only of the financial resources for the initial purchase but of the availability of man hours/years to produce a system that would work - would work with the students level of computer awareness, would work with staff cooperation and involvement and not just the innovators drive and be practically useful as a supplement or alternative to usual teaching procedures. The management of innovation is a problem which has been with us a long time and with electronic wizardry and its rapid growth there is just that much more fear about the nature of the innovation.

On the positive side the department is now able to accept the presence and use of a microcomputer as a teaching, administration and research aid. With the expertise and background we have we can now sensibly sit down and plan not only where we would like to be but how we are going to get there.

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Chapter 5:
OTHER ISSUES AND TOPICS

The final four papers address matters not encompassed in the previous section. Coombe provides an introduction to the rapidly growing literature relating to cognitive style and suggests ways in which some of the findings can be applied to teaching and learning. Battersby contributes two papers. One addresses the topical issue of equality of access to higher education. The other examines the potentialities of the Delphi technique as an aid to research and development in higher education. Finally, Imrie presents a model for the assessment of student performance designed to enhance learning rather than simply make comparative judgements.

Does Your Cognition Have Style?

Kennece Coombe
Massey University

ABSTRACT

During the past thirty years, the concept of cognitive style has received much attention from researchers in the fields of education and psychology. The purpose of this paper is to provide a summary of this past research, to reappraise briefly the more recent literature and to draw from this the implications such research has for higher education.

Kennece Combe, B.Ed.(Waikato), Dip.Teach. was formerly a primary teacher in the A.C.T. and in New Zealand, and is currently engaged in post-graduate research on the continuing education of the elderly.

Address for Correspondence: K. Coombe, Dept. of Education, Massey University, Palmerston North, New Zealand.

INTRODUCTION

The concept of cognitive style has received a great deal of attention from researchers during the past 30 years. This paper sets out to examine (a) some of the many definitions that have evolved to describe the concept; (b) researchers' perceptions of the manner in which cognitive styles develop; (c) the different types of cognitive styles; (d) and the implications research in this area has for higher education.

DEFINITIONS

The term 'cognitive style' is a comparatively recent addition to the language of educational psychology, and perhaps because of its youth there appear some differences in the detail of its definition, although the broader concept remains fairly stable. When considering differences and similarities between definitions, it should be borne in mind that definitions generally reflect an interpretation of the concept which best aligns with a given researcher's preferred area of study.

Kogan (1971) suggests that in defining cognitive style contrasts can be made with ability:

> "Cognitive style can be most directly defined as individual variations in modes of perceiving, remembering, and thinking, or as distinctive ways of apprehending, storing, transforming and utlizing information. It may be noted that abilities also involve the foregoing properties, but a difference in emphasis should be noted. Abilities concern level of skill - the more and less of performance - whereas cognitive styles give greater weight to the manner and form of cognition (p. 244)".

Commenting on Kogan's definition, Harker (n.d.) says that the distinction between the quantitative nature of cognition and the qualitative nature of cognitive processes involved is an important one because of the links between educational practice and cognitive abilities.

A different perspective on cognitive style is presented by Shouksmith (1970) who interprets the concept, from the work of Bruner, Goodnow and Austin (1956) as being a larger scale strategy which involves the "utilization of previous experience to establish expectancies (p. 87)". Shouksmith goes on to say that recurrence of these strategies denotes a particular cognitive style.

The issue of 'strategy' and style is taken up by Wallach and Kogan (1965) who summarise the difference between these two concepts in terms of categorization and conceptualization. They conclude that any difference depends largely on the interpretation of the researcher. Wallach and Kogan also suggest that those investigations with a background in psychoanalytic ego psychology conceive of cognitive styles as using categorization and conceptualization as "adaptational control mechanisms ... that mediate between need states and the external environment (p. 95)". Bruner, Goodnow and Austin, on the other hand, see categorization and conceptualization as

> "... involving such matters as types of error minimization and risk-taking in the making of cognitive decisions (Wallach and Kogan, 1965, p. 95".

This is the strategy definition.

A more general definition of cognitive style is given by Archer (1970) when he suggests it is "a preferential mode of categorization expressed in a situation where alternatives are possible (p. 73)". For the purposes of this paper, however, an even broader definition of the term seems appropriate, and for this reason Craig's (1980) understanding of the concept as "a person's characteristic pattern of information processing (p. 446)", has been chosen.

DEVELOPMENT OF COGNITIVE STYLES

One point of interest arising from the diversity of definitions given above relates to how various researchers perceive the development of cognitive styles in individuals. Several researchers (e.g., Bruner et al, 1956; Forman and Sigel, 1979; Craig, 1980) espouse the view that cognitive style develops because of early training, cultural life styles and life experiences. Others, such as Kolb (1976), Kogan (1976)

and Gregorc (1979) agree with Witkin's (1973) view that the work on cognitive style represents "different ways of cutting the personality 'pie' from those traditionally used (p. 22)". Gephart et al (1980) go further and state that styles emerge from inborn, natural inclinations which include "preferred ways of learning and descriptions of personality characteristics which related to learning (p. 1)".

A general conclusion that could be drawn from the foregoing is that some determinents of cognitive style possibly exist pre-natally and these may be modified by life experience. Damusis and Desjarlais (1977) even go so far as to argue that cognitive styles may be modified through mediation and musical training.

TYPES OF COGNITIVE STYLE

The previous two sections of this paper have served the purpose of providing a frame of reference for the array of styles that have been identified. Indeed, while it appears that cognitive styles may be highly idiosyncratic to the individual, it is possible to identify several broad categorizations of cognitive style.

Messick (1970) lists nine categories of cognitive style as follows:

1. Field dependence versus independence
2. Scanning
3. Breadth of categorization
4. Conceptual style/differentiation
5. Cognitive complexity versus simplicity
6. Reflectiveness versus impulsivity
7. Levelling versus sharpening
8. Constricted versus flexible control
9. Tolerance for incongrous experiences

Several years after Messick published this list of categories, Kogan (1976) proffered the view that there may be an indefinite number of dimensions that could be added to Messick's list, and because of this, Kogan proposed a three fold classification as a more valid base for conceptualizing cognitive styles. This classification into Types I, II and III cogntive styles is based on distance from the ability domain. Kogan describes Type I styles as 'more or less veridical', that is closest to being in the true ability domain. The issue of veridicality does not arise for types II and III. Nevertheless, in considering Type II styles a greater value may be assigned to a particular kind of performance relative to another. Kogan continues:

> "If one style correlates significantly with ability indeces, whereas and alternative style does not, the former tends to be endowed with greater value (p. 6)".

Kogan points out, however, that such value choices are sometimes made on purely theoretical grounds depending on the perceptions of worth of the researcher.

Type III styles are classified in value-neutral terms primarily because "investigators have not found a consistent pattern of correlates to suggest.... consistent cognitive advantage (Kogan, 1976, p. 6)", as in the case of broad versus narrow categorization. In cases where research does indicate a significant advantage of one style over another, Type III styles may be reclassified as Type II.

Like Kogan, Kolb (1976) also categorizes styles into types (I to IV), however, he attaches no value difference to any type, since types are representations of what we do first. Kolb's 'learning styles' can be represented as is shown in the Table on the page following.

From this Table, for example, Type II learners perceive intellectually (i.e. stand outside to examine the situation) and then process the information by reflecting upon it. Type IV learners, on the other hand, perceive concretely and process actively. Following Gephart et al (1980) these four types can be tabelled as:

Type I : Reflective sensor-feelers
Type II : Reflective thinkers
Type III : Thinking doers
Type IV : Doing sensor-feelers

TABLE ONE

Kolb's (1976) Learning Styles

Process	Perception: Concrete (senses feeling)	Perception: Abstract (intellect)
Reflective (watching)	I	II
Active (doing)	IV	III

In summary, then, even the small sample of cognitive style groupings presented here serves to illustrate the complexity of the notion of cognitive style, and the confusion into which one is thrown when trying to assess and draw implications from the research on cognitive style.

STUDENTS IN HIGHER EDUCATION

The work on cognitive style in the higher education context seems to revolve around two cognitive tyles: field dependence (*fd*) - independence (*fi*) (Witkin, 1977), and convergence - divergence (Hudson, 1966, 1968). This latter dimension, in some degree, can be linked with work on syllabus - bound and syllabus - free students (Parlett, 1970).

On the dependence-independence continuum, Witkin (1977) confirmed that the dimension had almost no relationship to overall academic performance. Similarly, there was no strong direct relationship found between academic performance and Hudson's dimension (Wilson, 1981). Nevertheless, Wilson (1981) suggests that:

> Cognitive style is predictive of initial choice and persistence in academic subject and career choice, and has implications for teaching methods. Fi's tend to choose subjects where analytical skills are called for (e.g., physical and biological sciences, maths, engineering, etc.) and to enter related occupations; fd's choose social sciences and humanities. But choice of subject is influenced by many factors including social expectations, occupational prospects, etc., and there is evidence that students move away from fields which are incompatible with their cognitive style towards more congenial specialisms. Thus, within science, fi's are likely to be persisters, while fd's will transfer to courses in arts and social science; traffic in the other direction is likely to be lighter, partly because of the inherent difficulties of qualifications and course requirements, but also because of the 'broad gauge' nature of the arts and social science field. A subject like psychology, for example, has both a 'hard' scientific 'end' (in experimental psychology) and a 'softer' human end in clinical or social psychology, so that all students can find a niche congenial to their cognitive style. (p. 140-141)".

The hard-soft dichotomy also seems to be applicable to the converger/syllabus-bound (sylb) and to the diverger/syllabus-free (sylf) categories. The sylb takes a conventional view of study while the sylf is more likely to be radical and questioning. Wilson (1981) continues:

> "Convergers are like sylbs in that they enjoy the structured setting of the school and are more likely than divergers (in a ratio of 3:1) to choose subjects such as maths, physical science and classics where the subject matter is unambiguous. Divergers, on the other hand, found school boring and restricting: they were much more likely to study subjects on the arts side such as English, history and modern languages. (p. 146)".

A broad categorization such as cognitive styles provides, is sufficient to lend some parameters to a discussion of the implications for teaching in higher education.

IMPLICATIONS FOR HIGHER EDUCATION

Cognitive style has implications both for what students learn and how they should be taught. Hence, a great deal of the writings on cognitive style and education tends to concentrate on the benefits or otherwise of matching and mismatching the cognitive styles of student and teacher. Kozma (1977) suggests that students could be grouped according to similarities and that a teacher with corresponding attributes could be assigned to teach this group through media and methods suited to their needs. Such a concern is reflected in the more recent work of Witkin (1977) who investigated whether cognitive style affected teaching behaviour. Wilson (1981) reports that Witkin's findings suggest that:

> "Fd's (teachers) social orientation leads them to favour discussion methods and to allow students a greater role in structuring the learning situation; they give less negative evaluation to pupils, a finding consistent with their greater reliance on others for self-definition and their consequent need to maintain good relationships. Fi's, on the other hand, emphasise structure in their teaching, even in 'discovery' situations make many references to standards, and criticise pupils. But both groups of teachers are viewed as equally competent (p. 141)".

While it seems clear, then, that it may be beneficial matching teaching style with learning style, Gephart and his colleagues (1980) point out that this match may, in effect, be difficult to achieve. They go on and cite five different methods of matching, from which the choice of one method over another is related to one's beliefs about the dynamics of education.

Despite the apparent complexity of matching teaching and learning styles, Good and Brophy (1980) comment that students "tend to do better when matched on cognitive style with their teachers (p. 516)", but qualify this by saying:

> "It is not clear that students or even teachers would be better off if matched in ways likely to reinforce their existing preferences, especially not if they lie at the extremes of this psychological differentiation dimension (p. 516)".

Indeed, Good and Brophy suggest that people who are either extremely field dependent or independent should be encouraged to operate in their non-preferred mode to gain the advantage of flexibility. This is cautiously echoed by Gephart et al who nevertheless deliver the following warning:

> "It has been found that periodic mismatch of major preferences can be tolerated and even viewed as acceptable, as varietal, as challenging. On the other hand, prolonged and chronic mismatch can result in stress, even burnout (p. 4)".

Although such a statement cannot be accepted unquestioningly, it does respresent the concerns held by one section of the educational research community.

Apart from the matching versus mismatching debate, other implications drawn from the work on cognitive style relate to the differing achievements of students with field dependent or independent teachers (Wittrock, 1970; Saracho and Dayton, 1980), and considerations teachers should give to students with cognitive styles different from their own:

> "Although students working within the subject area which matches their cognitive style do appear to have somewhat higher achievement than unmatched students, perhaps the more important contribution of the research to the study of academic performance is in helping to explain such factors as persistence, drop out and transfer (Wilson, 1981, p.142)".

From what Wilson (1981) says, one could assume that students will probably tend to move into areas of study that are more congenial to their cognitive style. If this assessment is accurate, then much of the match - mismatch debate concerning students and teachers in higher education could prove to be fruitless.

SUMMARY

In summary, then, from the wide range of definitions of cognitive style offered, the broad interpretation of a 'person's characteristic pattern of information processing' was chosen since this reflected the vital component of pattern and processing. In the development of cognitive styles, the possibility that determinants exist pre-natally was raised though such predispositions are likely to be modified by life experiences. Recent research on students in higher education brings to light the evidence that students may be either syllabus-bound or syllabus-free and in tandem with inclinations towards either the field dependent or independent extremes of the continuum which may determine the field of study students select. The implication for higher education generally that such a concept illuminates is basically that of explaining or predicting drop-out or transfer between subject areas. Even now, however, practitioners are warned to beware of the self-fulfilling prophecy.

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Equality and Ideology in Higher Education

David Battersby
Massey University

ABSTRACT

Literature in the field of higher education has, until recently, been pervaded by psychologism, particularly in seeking to provide the much sought after solutions to, and the panaceas for, the issues and problems in teaching and learning in higher education. Rarely have there been attempts to challenge the dominance of this psychological paradigm, and as a result attention has often been diverted from addressing and debating some of the manifest social issues, such as the inequality and ideology which is perpetuated and socially reproduced via higher education. This paper, then, will attempt to provide an impetus for debate concerning some of these social issues. In particular, attention will be focussed on the question of 'equality of access' to higher education.

David Battersby, B.Ed. (CCAE), D.Phil. (Waikato) is a lecturer in education. He has previously taught at the University of Waikato, and his current interests are the sociology of higher education, academic staff induction and socialisation, and the uses of the Delphi Technique in higher education.

Address for Correspondence: Dr. D. Battersby, Dept. of Education, Massey University, Palmerston North, New Zealand.

INTRODUCTION

Debate on educational equality invariably is politicised, and frequently exposes a myriad of entrenched ideological views about the nature of man, society, and the role of various institutions within society. This has been evident especially during the last three decades with the voluminous amount of research and literature on social class and educational achievement, compensatory education and cultural deprivation. Indeed, the number of reviews and critiques of findings from Committees of Inquiry (e.g., Newsom Report, 1963; Coleman, 1966) and research in these areas, alone number several hundred. Much of the attention, however, has been focussed on primary and secondary education, and until recently the question of whether educational equality is promoted by tertiary institutions has not been addressed with fervour. This paper, then, attempts to redress this by drawing on data from several recent studies, and by extending the arguments of various theorists, particularly those associated with the neo-Marxist perspective on education. In the first part of the paper some existing data on inequalities in tertiary education will be examined briefly. This will then be followed by a discussion centering on various perspectives about equality within institutions of higher education.

INEQUALITY IN HIGHER EDUCATION: MYTH OR REALITY?

It is often acknowledged that institutions of higher education are specifically designated social establishments within which learning, teaching and research can take place in an organised and systematic fashion (see Jeffreys, 1971). However, it is increasingly being recognised that most of those engaged in these practices are from the elite social group in society.

In Britain, for instance, Banks (1976) has pointed out that social class differences in educational opportunity are as prevalent in higher education as in other forms of formal education. It is common knowledge, says Banks, that school leavers from the working classes are less likely to reach Oxford or other of the high status universities. This type of inequality in higher education has also been shown to exist in Australia. Fensham (1980) and his colleagues, for example, in their report of Students in Australian Higher Education, comment that:

> "In both universities and colleges of advanced education the younger students are much more likely to be from families of higher social status, to have attended a private school, to be of Australian parentage and to be Australian born. (p. 196)"

The Fensham report also suggests that the social composition of higher education students in Australia seems to have altered very little over time. The report continues:

> "The few pre-war studies and the large number of post war studies all show that the higher status social groups ... are consistently over represented. (p. 197)"

Studies by Vellekoop (1969) and Harker (1974) seem to suggest that a similar trend may also exist in New Zealand.

More surprising, however, is the data presented by Dobson (1977) on social status and inequality of access to higher education in the USSR. Using previously published data by Soviety academics, Dobson was able to show that:

> "... the process of social selection performed by the educational system in the USSR is in many ways similar to that observed in other industrial countries (p. 269)."

According to Dobson, this situation is politically sensitive in the USSR, given the egalitarian ideology which is vigorously promoted by officials in that country.

In view of the foregoing, then, it seems apparent that educational inequality in higher education is a reality in countries of both the East and West. This inequality is an inequality of access, resulting from a series of selection and elimination processes. Not only to these processes favour certain social classes, but ethnic groups also seem to be disadvantaged in terms of access to higher education (see Coleman, 1966).

Because so little information is available on inequality between males and females within higher education, those students who are disadvantaged by a restricted choice of disciplines, and the differential levels of achievement among students in tertiary education institutions, the remainder of this paper will focus discussion on the question of equality of access, and whether this should be promoted by tertiary educational institution.

EQUALITY IN HIGHER EDUCATION

In addressing the issue of access to higher education it is possible to adopt one of several ideological standpoints. As an example, Brubacher (1976) takes a rather conservative view and suggests that since it is not possible to provide "higher education for all", and as higher learning may be beyond the intellectual capacity of a significant proportion of people, then the only logical alternative is that access should be decided on the principle of meritocracy. In Bates' (1980) words:

> "The theory of meritocracy is simple: it states that IQ plus Effort equals Merit, and Merit of course deserves Rewards (p. 256)."

Brubacher maintains that the idea of meritocracy is relatively easy to justify, and elaborates on this assertion by making reference to Plato's Republic. In doing so, he introduces the notion of 'reverse discrimination' as a compensatory measure for those with 'handicaps':

> "... the theory is that the underprivileged must be given increased opportunities until they catch up. Some prefer to see such reverse discrimination not as compensation for yesterday's injustice and discrimination but as an attempt to insure just distribution of social goods - in this instance, education (p. 61)."

The arguments advanced by Brubacher, and the ideology which underpins them, present a popular conception of the role of tertiary educational institutions in the debate on equality of access (see also, Barzun, 1968; Wolff, 1969; Gould, 1970; Williams, 1979). That is, higher education is legitimated on the assumption that, through the formal processes of schooling, people have the "chance" and "opportunity" to obtain the necessary credentials for entry into tertiary education. Moreover, for those who do not meet the requirements, there are various "non-traditional" avenues for gaining entry into higher education. In this light, tertiary educational institutions are often seen as legitimate and just, providing equality of access via the principles of meritocracy, egalitarianism, and reverse discrimination.

It seems timely, particularly in view of the discussion in the initial section of this paper, to challenge this popular notion of how tertiary education functions to promote equality. Indeed, what appears to be reality is that institutions of higher education legitimate and promote inequality through adoption of principles such as meritocracy. Bowles and Gintis (1976), who espouse a neo-Marxist ideology, support this contention and argue convincingly that educational and occupational attainment are related to family background rather than to talent or ability. Thus, the children of the wealthy and powerful tend to gain access to tertiary education and obtain high qualifications irrespective of their ability. On the basis, then, of similar evidence presented earlier in this paper, Bowles and Gintis maintain that education, including tertiary education, provides the legitimation of pre-existing economic disparities.

If the Bowles and Gintis analysis is correct, then tertiary education can be seen as part of a giant myth-creating mechanism which serves to justify inequality, rather than to promote equality. In other words, tertiary education creates the myth that those who have gained access deserve the privilege, that they have achieved this status on merit and that those who are refused entry really only have themselves to blame.

The Bowles and Gintis argument, then, rejects the conservative, functional view of Brubacher, and suggests that, under the guise of much rhetoric about equality through meritocracy, the real function of tertiary education is that of social and cultural reproduction. This latter notion has been taken up by Pierre Bourdieu and

his colleagues at the Centre for European Sociology in Paris. Their approach, like that of Bowles and Gintis, has also been strongly influenced by a Marxian ideology.

According to Bourdieu (1971, 1973, 1974, 1979) the major role of all educational institutions is that of 'cultural reproduction', and in particular the reproduction of the culture of the dominant classes in society. Referring to the dominant culture as 'cultural capital', Bourdieu maintains that this capital is not evenly distributed throughout the class structure in a capitalist society. Hence, for those with little cultural capital (e.g., the working class; some ethnic minorities), the educational system becomes a 'cooling-out' process, and eventually those who gain access to teritary education are usually from the middle and upper classes in society. Bourdieu and his colleagues would argue that the majority of students in higher education have been socialised into the dominant culture and hence have cultural capital, which via the credentials obtained, can be translated into wealth and power. In effect, then, tertiary education contributes to the reproduction of power and privilege between social classes. That is, the privileged position of those in universities and tertiary colleges is able to be justified by the notion of 'educational success', and the underprivileged position of those not involved in this type of education (those generally from the lower classes) is legitimated by the notion of 'educational failure'.

Unlike Bowles and Gintis, Bourdieu does explore the question as to whether tertiary educational institutions should promote educational equality. He argues that the system of higher education

> ... is required to produce individuals who are selected and arranged in a hierachy once and for all, for their whole lifetime. Within this logic, to seek to take account of social privileges or disadvantages and to arrange individuals in a hierarchy according to their real merit, that is according to the obstacles overcome, would require ... classification in terms of handicap (Bourdieu and Passeron, 1979, p.68)."

Such a classification, say Bourdieu and Passeron (1979), is not only totally alien to the ideology upon which tertiary education is founded, but would threaten the justificatory ideology which enables the privileged classes 'to see their success as the confirmation of natural, personal gifts'. Hence, while the ideal of equality may be striven for, the very nature of the system, in Bourdieu and Passeron's analysis, makes it an unrealistic goal.

The unrealism and rhetoric associated with the debate for equality in education has been one of the major, contributing factors which has prompted a number of education theorists, mainly from the London Institute of Education (e.g., Young, 1971; Lawton, 1975) and the Open University (Cosin, 1971; Cosin et al, 1972), to suggest that the issue of educational equality is, in reality, a problem of knowledge and control Arguing from a perspective, which has its roots in Marxism and Phenomenology, the advocates of the knowledge and control thesis contend that those in positions of power tend to define their own knowledge as superior, to institutionalise it in educational institutions, and to measure educational attainment in terms of it. The outcome of this is that the established order is maintained and that power and privilege within social groups is reinforced.

While the knowledge and control argument has been criticised on epistemological grounds (see, Bernbaum, 1977), it does pose an interesting response to the question of promoting equality in higher education. That is 'debate on equality' has been not only fruitless, but has contributed in large part to diverting attention from challenging much of the conventional wisdom and taken - for -granted notions in education. Bates (1980) summarises these as follows:

1. What counts as knowledge?
2. How is what counts as knowledge organised?
3. How is what counts as knowledge determined?
4. How is access to what counts ad knowledge determined?
5. What are the processes of control?
6. What ideological appeals justify the system? (p. 262)."

CONCLUSION

The argument advanced in this paper is that inequality in higher education is a reality, but that there are competing perspectives and ideologies offered in interpreting both this inequality and whether equality can and should be promoted by tertiary educational institutions.

In the first section of the paper a cursory analysis of some existing literature in the field suggested that there was a substantial body of research to support the view that higher educational was characterised by inequality, particularly inequality of access. Because so little was known about other forms of inequality in high education (e.g., inequality between males and females), it was decided to focus the second part of the paper on this question of equality of access. Here, four differing perspectives were elucidated: the functional conservative view (Brubacher); the Bowles and Gintis anlaysis; the social and cultural reproduction argument (Bourdieu); and, the knowledge and control thesis (Young). Basically, the first of these perspectives suggested that tertiary educational institutions currently promote equality via a system of meritocracy whereby most people have equal chances and opportunities of gaining access to higher education. The following three perspectives gave differing, radical views of equality, and its place in the myth-making, the reproduction of the existing social order, and in diverting attention from the taken-for-granted issues, in tertiary education.

The weight of evidence presented in this paper supports the contention that if tertiary educational institutions had the unconditional goal of enabling the greatest possible number of individuals access to, and equal chances of success in, higher education, then such a goal would be opposed to both the latent and manifest functions of tertiary education.

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The Delphi Technique: Its Methodology and Application in Higher Education

David Battersby
Massey University

ABSTRACT

The Delphi Technique was designed originally to apply expert opinion to urgent defence problems in the United States during the early 1950's. Modifications to the technique over the past two decades have made it a potentially viable instrument for research and development utilization in the field of higher education. In the first part of this paper, the origins, characteristics and general applications of the technique are considered. A classification of Delphi investigations in higher education is then developed, and from this three case studies are chosen to exemplify particular uses of the technique. The paper will conclude by making brief reference to some of the methodological problems concerning Delphi.

David Battersby, B.Ed. (CCAE), D.Phil. (Waikato) is a lecturer in education. He has previously taught at the University of Waikato, and his current interests are the sociology of higher education, academic staff induction and socialisation, and the uses of the Delphi Technique in higher education.

Address for Correspondence: Dr. D. Battersby, Dept. of Education, Massey University, Palmerston North, New Zealand.

BACKGROUND

The Delphi Technique was originally designed to apply the opinions of experts to urgent defence problems in the United States. The first published reference to the Technique appeared in a paper by Helmer and Rescher in 1959, and in 1963 Helmer and another of his colleagues (Dalkey) reported on the technique in a description of an experiment carried out in the early 1950's. This experiment, conducted under the auspices of the United States Air Force and the RAND Corporation, became known as "Project Delphi". The project's objective was to apply the opinions of a small number of experts to the selection of key industrial targets in the United States, and then to the estimation of the effects of strategic nuclear bombing by the Soviet Union on these targets. Specifically, the group of experts was asked:

> "What is the least number of bombs that will have to be delivered on target for which you would estimate the chances to be even that the cumulative munitions output during the two year period under consideration would be held to be no more than one quarter of what it otherwise would have been? (Dalkey and Helmer, 1963, p. 461)."

The "Delphi Technique" was the name given to the method designed to obtain the most reliable consensus of opinion from the group of experts.

Basically, the technique consisted of a series of questionnaires, the second and subsequent members of which fed back information to the experts (who remained anonymous to each other) while giving them the option to change their opinions in the light of the feedback. Dalkey and Helmer, who are now recognised as the pioneers of Delphi, claimed that this type of controlled interaction avoided many of the disadvantages common with the more conventional use of experts in roundtable discussions and other forms of meetings. They maintained that confrontations in these face-to-face encounters often

(a) induced the hasty formulation of preconceived notions;
(b) inclined one to close his/her mind to novel ideas;
(c) led to the defence of a viewpoint once it was presented; and,
(d) predisposed people towards persuasively stated opinions of others.

Dalkey and Helmer suggested further than the Delphi method enabled a researcher to explore systematically some of the factors influencing people's judgements and decision making. Their technique, therefore, made it possible not only to draw attention to misconceptions and predispositions harboured by individuals, but also to highlight those factors which may have been overlooked in the first analysis of the situation. In their critique of the Delphi procedure, however, Dalkey and Helmer cautioned that the method:

> "... is highly conducive to producing preliminary insights into the subject matter at hand on which a more effective research program may be based even though the predictions obtained in the form of an opinion consensus may be lacking in reliability. (p. 467)".

CHARACTERISTICS OF THE DELPHI TECHNIQUE

McGaw et al (1976) point out that since its original use, Delphi has been modified so often that its initial form is difficult to resurrect. Despite this fact, it is possible to identify broadly a number of general procedures (these are shown below) which have been followed by most users of the technique. Detailed accounts of variations in these procedures can be found elsewhere (Linstone and Turoff, 1975; O'Brien, 1978; Ceesay, 1982).

In its simplest form, the Delphi method employs a panel of respondents (not necessarily experts) to make a series of individual and anonymous judgements relating to an assigned problem. The technique has a number of distinguishable phases which are referred to as "Rounds":

ROUND 1: First, a panel of respondents is chosen. A questionnaire detailing a statement of the problem being investigated is then sent to the participants. Usually, they are asked to reply to a number of questions and/or to express an opinion or judgement concerning a solution to the problem.

ROUND 2: Once Round 1 questionnaires are returned, the responses are screened and edited to eliminate repetition, and where appropriate, a statistical analysis (e.g. median, interquartile range) of the response distribution is undertaken. Another questionnaire is then developed and given to participants along with the summary of the previous round's replies. Individual respondents also may have their first round answers returned where this is convenient for the researcher. In the light of the information which has been fed back, a reply to the problem is sought once again. As part of this exercise, some of the panelists whose round one responses deviated from the norm, may be asked to provide a brief rationale for their previous answer and their new reply. This procedure often exposes a number of valid reasons for deviant responses. It also could clarify, for instance, whether the problem has been misinterpreted or dishonestly answered.

ROUND 3: As with the preceding round, all the responses from the returned questionnaires are summarised and fed back to respondents. Again, they may be directed to reconsider the issues, and those who gave deviant replies may be asked to provide justification for both their previous and new answers. Rating scales are sometimes employed in this round, particularly if the researcher is confident that a degree of consensus has been reached. With the use of these scales, panel members can indicate, for instance, the 'importance' or 'feasability' of various solutions to the problem, or the 'desirability' of certain events should they occur.

Depending upon the nature of the problem being investigated and the degree of consensus that is sought, the researcher may have little need to go beyond three rounds. However, should additional rounds be employed, their construction and administration are similar to that adopted above.

In summary, then, the Delphi technique, as an instrument to generate consensus of opinion, is characterised by: response anonymity, a number of iterations and information feedback. Various applications of Delphi are highlighted in the following discussion and in the case studies which appear later in this paper.

APPLICATIONS OF DELPHI

It has already been mentioned that the results of the original Delphi project first appeared in an article by Dalkey and Helmer in 1963. Since then, it is conservatively estimated that more than 1000 investigations using the technique have been published. In reviewing some of this research, Linstone and Turoff (1975) found that, while many people had applied Delphi as a forecasting procedure, it also had been used for:

- Gathering current and historical data not accurately known
- Examining the significance of historical events
- Evaluating possible budget allocations
- Exploring urban and regional planning options
- Planning university campus and curriculum development
- Putting together the structure of a model
- Delineating the pros and cons associated with policy options
- Developing causal relationships in complex economic and social phenomena
- Distinguishing and clarifying real and perceived human motivations
- Exposing priorities or personal values, social goals

Over the past 15 years, Delphi's use has spread from America to Europe and the Far East. It has found its way into government, industry and management, and has been used to deal with such public issues as: environment, health, transportation, social wealfare, recreation and education. For instance, recent studies utilizing the Delphi Technique demonstrate its wide applicability, and several of these studies are shown in Table 1.

TABLE 1

Some Recent Studies Utilizing
the Delphi Technique

Researcher(s)	Year	Area of Application
M. Kunicki	1978	Information Science: Using Delphi to forecast 'information activity' in Poland
F.J. Romm, B.S. Hulka	1979	Health Care: Developing critiera for quality of care assessment
K.G. Loughlin, L.F. Moore	1979	Medicine: Developing objectives and activities in a Pediatrics Department
W.R. Dunlop, E.V. Collier	1980	Computing: Using Fortran computer programmes for Delphi calculations
H.W. More	1980	Police Studies: Delphi Analysis of Police Corruption.

APPLICATIONS OF DELPHI IN HIGHER EDUCATION

The uses of Delphi in higher education can be classified into the following categories:

(a) Forecasting
(b) The formulation of goals and objectives
(c) Planning
(d) Developing evaluative criteria

Within each of these areas, it is possible to distinguish between exploratory and normative applications of the technique. Exploratory Delphis are those which seek to forecast a picture of an expected future or series of events. On the other hand, normative Delphis are those which are used in planning and forecasting events and developments that are desired as well as in designing evaluations and in formulating curriculum objectives. The major differences, then, between the normative and exploratory Delphi are that:

> "...firstly normative forecasting is concerned with what one thinks is desirable rather than what one thinks is probable and secondly that normative forecasting is not strictly temporal. It is not concerned with when something will occur but whether or when it should occur. Hence, normative forecasting, involves the added dimension of the use of value judgements (Lonsdale, 1974, p. 63)".

Another useful distinction to be made in categorising the use of Delphi in higher education is to designate the different types of respondent groups employed by researchers. A number of Delphi studies, for instance, have utilized a single group of expert respondents, while others have tended to be more socially representative in their choice in participants.

In adopting these two ways of distinguishing Delphi studies, Table 2, on the following page, exemplifies a small sample of Delphi investigations undertaken in

TABLE 2

Examples of Delphi Studies in Higher Education

Researcher(s)	Year	Title/Object of study and Sample	Type
		Single Group of Expert Respondents	
H.J. Dyck, G.J. Emery	1970	To prepare a series of forecasts on social conditions which tend to be important in educational planning.	Exploratory
A.M. Fox, W.K. Brookshire	1971	To list the ingredients of effective college teaching.	Normative
R.D. Shepardson	1972	To survey arguments for and against developing a Performance-Based Teacher Education programme.	Normative
		Several Groups of Expert Respondents	
O. Helmer	1966	To produce a list of goals and innovative futures for education.	Normative
R.C. Judd	1970	To sample a variety of attitudes within a Liberal Arts college towards an experimental curriculum.	Normative
D.P. Norton	1970	To determine state university needs in Illinois.	Normative
D.E. Berghofer	1971	To identify a number of problems related to general education which would be likely to affect Albertan society during the next thirty years.	Normative
D. Battersby	1977	To use students ratings as an assessment of lecturer role performance	Normative
		Range of Client Interest Groups as Respondents	
F.R. Cypert, W.L. Gant	1970	To clarify and assess the wishes, aspirations and opinions of clientele regarding objectives for the School of Education at the University of Birginia.	Exploratory
N.P. Uhl	1970	To investigate (in a small number of institutions) what on-campus and off-campus groups perceive the goals of their institutions to be, as well as what they believe the goals to be.	Normative
H.T. Courts, S.C.T. Clark	1972	To generate a number of targets for the future of teacher education.	Normative

the general area of higher education. Three of the studies shown in Table 2 have been chosen for discussion below so as to illustrate briefly some of Delphi's applications.

CASE STUDIES OF DELPHI'S USE IN HIGHER EDUCATION

Case Study 1: Developing a Performance-Based Teacher Education Programme

Shepardson (1972) made use of the Delphi method to survey arguments for an against developing a performance-based teacher education (PBTE) programme at the University of Texas at Austin.

Adopting an open-ended round one questionnaire, Shepardson asked the faculty of the Department of Curriculum and Instruction at the University of Texas, to state their arguments, both for and against, concerning the development of a PBTE programme. Resulting from this exercise, a list of 41 arguments for PBTE and 35 against were gathered from 27 respondents.

In the second found, participants were requested to rate each of these two sets of statements according to its validity and to give a significance rating to those items they considered valid. The returns from this round were then analysed by tabulating the ratings. A summary sheet of the validity ratings for each set of arguments was then prepared.

For the final round, a rank ordering of the faculty's arguments for and against a PBTE programme, along with the total ratings for each argument, was returned to respondents. This was accompanied by a questionnaire which required each faculty member to indicate the value of restructuring each course area (e.g., elementary science education) along the lines of a PBTE programme. The replies from this round were then tabulated, and a final summary, containing the following results, was distributed to the faculty:

(a) description of the survey;
(b) the scores of the five highest rated arguments for and against PBTE; and,
(c) the composite ratings for restructuring the course towards PBTE.

For the purposes of this paper, and to exemplify the nature of Shepardson's findings, a section of his final summary is shown in Table 3.

In discussing the outcomes of his study, Shepardson maintained that the Delphi survey stimulated a high degree of fluency and flexibility that would have been difficult to obtain in a staff meeting. Moreover, Shepardson concludes that Delphi is beneficial in that it makes problem-solving and decision-making a more effective and creative process.

Case Study 2: Using Student Ratings to Assess Lecturer Role Performance

Battersby (1977) examined, by means of a three round Delphi, student assessment of lecturer role performance. A sample of 23 students (19 males and 4 females) pursuing a fourth year Education Course in Measurement and Evaluation at a New Zealand university, along with their lecturer, were chosen for this study. The basic design of the three round Delphi was as follows:

ROUND 1: In designing this round it was assumed that, in evaluating the role performance of a lecturer, a student would compare 'what is' with 'what is expected'. The first consideration then was to specify - in this case - the 'ideal' role of an education lecturer by ascertaining those behaviours which students and their lecturer deemed to be very important.

ROUND 2: The information derived from the previous round was analysed and fed back to the students in an itemised form. Students were then asked to rate their lecturer's actual role performance on each item.

ROUND 3: The data obtained from the student ratings was analysed and fed back to the lecturer for consideration. He was then interviewed concerning the usefulness of this role performance data.

For the first round, a 44-item questionnaire based on that used by Cooper and Foy (1967) and Magin (1973) was prepared. This questionnaire was comprised of items relating to the following categories of lecturer role performance.

TABLE 3

A Sample of Shephardson's (1972) Findings

Arguments Receiving the Highest Validity Rating For and Against the Development of a PBTE Programme

For	Against
1. A behavioural statement of course and program objectives will provide students with a better understanding of the program as a whole and the specific expectations held for them. This, in turn, will allow them to choose from a variety of alternatives for the course and steps they wish to take to fulfil the program goals or competencies.	1. The specification of goals and performance objectives for a teacher education program does not by itself make a program. There are many aspects of a truly individualised humanistic teacher education program that go beyond the specification of objectives in the cognitive and affective domains. There is a need for people to work together for a common goal that all agree to both philosophically and in action.
2. Minimum criteria for students could be defined.	2. There is a danger in a performance-based program to work only with those performances that can initially be identified and specified. If allowances are not made for easy modification of the program, the result could be one dealing with trivial skills and inadequate in preparing effective teachers.
3. The analysis of the task and the defining of the destination make the job of selecting the appropriate vehicle more accessible.	3. Some goals cannot be specified in behavioural terms. Teaching should not be restricted to just those things that can be stated behaviourally. Behavioural goals are a straw man that will restrict teaching to a series of extrinsic goals for the student. Intrinsic goals are what the students today feel are relevant. The factors of humanness (the judgements that people make about other human beings) cannot be omitted.
4. With an entire department focused on certain desired skills, teachers are more likely to enter teaching possessing these skills.	4. A performance-based program should not be the only type introduced. Several possible programs should be implemented and then researched for effectiveness.
5. If minimum performances are specified for the students, it is much easier to diagnose, and prescribe remedial measures and to work with individuals than it is to guess at where they might be or what they don't understand.	5. The department should not be committeed to a performance-based program before consensus is reached on what behaviours students must know before they teach.

Instruction (I)	- 13 items
Student Antonomy (SA)	- 5 items
Student Relations (SR)	- 10 items
Student Welfare (SW)	- 10 items
Personal Characteristics (PC)	- 10 items

Early in the second term of the academic year, this first round questionnaire was distributed to the students and their lecturer with the instruction that they were to indicate, on a five point Likert scale, the relative importance of each statment in defining the ideal education lecturer. Once returned, the distribution of responses to the questionnaire items was analysed , and a ranking of the ten most important characteristics of the ideal education lecturer was obtained for: the male students; the female students; the group of 23 students; and, the lecturer.[1] Table 4 details these rank orderings and the corresponding items.

It can be seen from Table 2 that of the ten most important characteristics derived from the male student responses, six were also highly ranked by the female students, while five of the items corresponded with those ranked important by the lecturer. In each instance, the rank orderings of these matched items varied. Altogether, six of the group's ten highest rating items were also ranked highly by the lecturer. However, those statements ranked 1, 3, 9 and 10 by the lecturer were not ranked by the students as being of importance. It can also be seen from the Table that the lecturer ranked statements relating to the promotion of Student Autonomy first and second respectively. In comaprison, the group of students saw characteristics of Instruction as being the most important attribute of the ideal lecturer, and this category of items was ranked first and second.

In mid-third term, the second round questionnaire, consisting of all the items shown in Table 4, was fed back to the students. They were informed that this list of items represented those characteristics of the ideal education lecturer which they and their lecturer had ranked as being important. Accompanying this information were instructions relating to the assessment of the actual role performance of their lecturer. Specifically, the students were asked to indicate, 'How often their lecturer had done each of the following ...' Answers were to be given according to the code: always, or almost always; usually, sometimes; rarely or never; or, not sure. It was decided that only a 'yes/no/not sure' option should be provided on the last two questionnaire items shown in Table 4.

In analysing the returns from thisround, a frequency count was made of the response distribution to each of the items and a folio containing this information, Table 4 and a brief accompanying description was then fed back to the lecturer several days after the completion of round two. This constituted the third round of the study.

Having been given the data on his students' rating of his role performance, the lecturer was then invited to comment on the data's usefulness. Below are some of his remarks:

> "The results have been helpful, particularly as an aid in my self-evaluation. They have also given me an interesting insight into my students' perceptions of my performance and this has been most beneficial. I think for an instrument such as this to have optimum value you should take the Delphi one phase further. That is, have a fourth round whereby the results are taken back into the class situation and are discussed. In this way particular areas of concern may be highlighted. In fact, as an instrument to generate this kind of discussion, I can see this technique having great potential..."
> "What was also advantageous about this approach was that you (the researcher) made no assessment of me - this is good. Having been left to do the assessment of the data myself, I tended to reflect on my teaching performance through the eyes of my students. This would have probably been impossible had you presented your assessment of me as a fait accompli."

Battersby concluded by saying that the three phase Delphi proved to be an effective procedure whereby a lecturer could undertake a formative evaluation of his/

TABLE 4

Item Rankings Derived from Round One Responses

RANKINGS				ITEMS	CATEGORY
LECTURER	GROUP	MALE	FEMALE		
	9			Discusses religious and moral issues	I
7	7	=1		Spends time helping a student with his or her own special learning problem	SW
8	5	5	4	Encourages students to seriously question his (the lecturer's) interpretations and conclusions in class	SA
2	4	3	6	Really encourages students to think for themselves	SA
	2	=1	5	Gives assignments that focus on significant aspects of his course, not on obscure points	I
			=9	Speaks clearly in his lectures	I
	10	10		Encourages students to pursue independent study	SA
6	1	6	1	Knows how to interest students	I
	6		3	Is not sarcastic with his students	SR
4	8	7	=9	Really talks with students, not just at them	SR
			7	Summarises the major points of a lecture	I
		4		Goes out of his way to simplify difficult problems	I
1				Presents opposing viewpoints and encourages students to make up their own minds	SA
3				Stimulates curiosity about particular areas of his course	I
9				Is available when students want to talk with him	SW
10				Treats students as equals rather than as subordinates	SR
	9		8	Sets textbooks which cover the course adequately	I
5	3	8	2	Considers the students' needs and interests in planning his course	SW

her role performance. Moreover, it was suggested that the three stage approach piloted in the study was advantageous in that the role definition of the 'ideal lecturer' was agreed upon by the students and the lecturer before an assessment of the lecturer's actual role performance was attempted.

Case Study 3: Defining Objectives for a School of Education

This final example of an application of the Delphi Technique focusses on the work of Cypert and Gant (1970). In the open-ended first round of their four phase Delphi inquiry, Cypert and Gant sought suggestions as to the prime targets on which the School of Education at the University of Virginia should concentrate its energies and resources for the next decade. Individual respondents, who represented a significant power structure relating to this School of Education, were chosen for this study on the assumption that:

> "... what those persons in positions of influence believe will happen or should happen is the best indication of what actually will occur in the near future (Cypert and Gant, 1970, p. 420)".

Table 5 details the seven categories of respondents who were involved in the investigation. Sixty-eight percent of the sample replied to round one, offering 750 individual suggestions which were reduced to 61 generic statements.

TABLE 5

Cypert and Gant's (1970) Sample of Respondents

Category	Number of Respondents
Faculty from the School of Education and selected student leaders from the graduate and undergraduate populations, University of Virginia campus.	89
Persons in positions of leadership in the University - deans, the president's cabinet and elected members of the University faculty senate.	58
Off-campus elements: educators, i.e., elementary and secondary school-teachers and administrators holding elective office in statewide professional organizations, deans of the major schools of education in the state.	41
Organizational leaders, not necessarily professional educators, such as the officers of the Virginia School Boards Association, the Virginia PTA, the State Counci of Higher Education.	48
Persons of paramount influence in political cricles, e.g., the education committees of the Virginia House and Senate, U.S. senators and representatives, the governor, etc.	73
Leading newspaper editors and persons dealing with education in such groups as the Virginia AFL-CIO, NAACP, Virginia Farm Bureau, and the Virginia Chamber of Commerce.	82
Selected teacher educators of national reputation from across the nation.	30
TOTAL	421

The purpose of the second round was to have respondents differentiate between the 61 generic items in an hierarchical fashion. Subsequently, the questionnaire for this round consisted of a random listing of the 61 statements. Participants were asked to rate each item on a five point scale. Replies were received from 262 of the 421 participants. These responses were processed to determine the distribution and mode of priorities assigned to each of the six items.

For round three, individuals were fed back their own rating and the group consensus on each statement. In the light of this feedback each replier to the previous round was requested to rerate all the items. Respondents who wished to remain outside the consensus on an item or items were asked to state their reason for doing so.

The returns from the third round were computed and on the basis of the results a fourth round questionnaire was constructed. This contained, once again, an individual's rating on each item as well as the mode response from the group. However, included with this information were 218 generic statements representing the dissenting opinions gathered in round three. Respondents were directed to rate each item based on their own values and knowledge of both the minority and majority views. Sixty-two percent of the original population returned responses for this round. Primary interest in the anlaysis of the results centred around the goals that attained high priority for the sample. Some of these have been listed in Table 6, along with those goals which were ranked lowest.

According to Cypert and Gant, the data generated from this four round Delphi proved most useful in formulating future targets of the School of Education at the University of Virginia. Furthermore, the authors commented that:

> "In addition to the satisfaction of planning one's future with the assistance of data - a pleasant change in educational circles - the survey made influential persons in the Commonwealth (of Virginia) aware of the School's existence and awakened them to a realisation of its future accomplishments (p. 425)".

CONCLUSION

Although Delphi appears to be a potentially viable technique in higher education research, its use does raise a number of methodological issues. Indeed, Lonsdale (1974) is of the opinion that:

> "Although over the last decade there has been considerable experimentation with the Delphi Technique ... these experiments have, in the main, been concerned with direct applications of the technique with little attempt to establish the realiability and validity of the findings, or have involved specific manipulations of the procedures aimed at the improvement of its technical aspects, such as improving the degree of consensus (p. 118)".

In summary form, the following are some of the methodological questions which need to be considered when using the Delphi Technique:

Panel Selection: The size of panels used in Delphi studies has varied considerably and this raises questions about the appropriateness of small as opposed to large numbers of respondents. Furthermore the critiera for panel selection often seem arbitrary and subjective (e.g., who is an "expert"?)

Delphi Rounds: Because so many different forms of the Delphi Technique have been used, questions concerning questionnaire design, number of iterations and the interval between rounds have largely been unanswered.

Information Feedback: This is a crucial function of Delphi, and yet there is little information available as to the influence feedback has on respondents, whether their opinions can be swayed by the style or type

TABLE 6

A Sample of Cypert and Gant's (1970) High Priority and Low Priority Goals

High Priority Goals	Priority 1:	Increasing the number of talented young people who enter and remain in the teaching profession.
	Priority 2:	Developing better methodology of teaching through research on such topics as motivation, study skills, individual differences, child development, creativity, the learning process, constructive thinking, cost, communication, educating the physically handicapped, teaching large groups and discipline.
	Priority 3:	Preparing educators to function effectively in innovative programmes that deal with constantly changing educational problems.
	Priority 4:	Developing knowledge concerning the effective preparation of teachers.
	Priority 6:	Developing programmes of nationally recognised excellence.
	Priority 8:	Attracting more men into elementary education.
	Priority 10:	Developing more equally balanced school divisions.
Low Priority Goals	Priority 56:	Developing a knowledge base that sets the parameters of capability and modus operandi of a school of education's function.
	Priority 57:	Modify the curriculum of the School of Education to give greater attention to Negro history, occupational orientation of children and citizenship education.
	Priority 58:	Assisting schools to develop better school buildings through such means as standard construction elements.
	Priority 59:	Preparing interdisciplinary courses for high school adoption.
	Priority 60:	Preparing plans that schools could use for goal definition.
	Priority 61:	Eliminating competition among institutions of higher learning in Virginia.

of feedback, and what effect different forms of feedback has on successive rounds.

Consensus: An underlying assumption of Delphi not often challenged is that consensus towards a common viewpoint carries with it greater "truth" in that the outcome is more accurate, or is wiser, or has greater value than some form of alternative course(s) of action. In other words, how does one establish the accuracy of consensus, and whether it is specious or authentic?

Socio-psychological Effects: What effect does the Delphi process have on respondents? In particular, how does self-perception, anonymity of responses

and emphasis on group opinion and consensus, influence individual participants? These issues have seldom been addressed.

Because of these methodological concerns, critics claim that Delphi cannot be recognised as a proven, scientific technique. While agreeing in part, one could argue that very few research technique are proven. Moreover, while not having the pervasive powers of a modern Oracle, information derived from using Delphi may not only "turn out to be an acceptable substitute for direct empirical evidence when the latter is unavilable" (Dalkey and Helmer, 1963, p. 467), but may provide the means of making decisions based on "more objective data than today's crude common sense decision-making method" (Hostrop, 1973, pp. 85-86).

NOTE

(1) In order to obtain a ranking of items from the lecturer, a second questionnaire was prepared. This contained all those items he had marked as 'very important' in the first round. He was instructed to rank the ten most important items.

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Allocating Grades Depends on Student Quality

Bradford W. Imrie
Victoria University of Wellington

ABSTRACT

Educational research which has focussed on specific aptitude/treatment interactions has been unsatisfactory because of the effects of other variables such as learning skills, assessment and environmental factors. This paper develops a conceptual relationship between the quality of a grade, the meaning of marks, the performance of a student and the quality of a student, with reference to a formal course of study. A distinction is made between student quality and student ability.

These considerations are represented by a student-referenced assessment model so that opportunities for intervention and improvement of student experience, can be identified. These responsibilities can be shared with students and the implications are discussed with reference to the interactions involved.

B.W. Imrie, B.Sc.(Eng.)(Lon.), M.Sc.(B'ham), works in the University Teaching and Research Centre. He is Master of Everton Hall - a student hall of residence. He has previously taught Mechanical Engineering at Paisley College of Technology and at Leeds University. He is the co-author of Assessing Students, Appraising Teaching and of a number of papers dealing with aspects of improving teaching and learning. Current interests are professional development of academic staff, assessment of student performance and evaluation of teaching.

Address for Correspondence: B.W. Imrie, U.T.R.C. Victoria University of Wellington Private Bag, Wellington, New Zealand.

INTRODUCTION

'Marks are, of course, measurements of educational achievement.' (Ebel, 1972)

This statement raises questions, of definition at least, which this paper will consider with reference to marking or grading, both of which have been described as the 'grubby stuff' of (university) teaching (Eble, 1976). The aim of this paper is to develop a conceptual relationship between the quality of a grade, the meaning of marks, the performance of a student and the quality of a student, with reference to a formal course of study. The relationship is also represented by a student-referenced assessment model so that the key considerations can be identified for intervention and potential improvement of student experience.

In this paper, grading will be considered as a procedure that produces a single grade (or class) to describe a student's achievement (or ability to achieve), after completing an assessment task, course or a programme of studies. A (final) grade is a qualitative description of student performance. It is derived from a single mark (often representing a combination of marks) and is usually related to the performance of other students. Grading is the process by which marks are translated and combined into a reporting scheme of (usually) 7 ± 2 discrete elements. (Note that the 'magical number' 7 indicates an approximate limit for human discrimination (Miller, 1956) and that this has significance for the marking process and its reliability.)

RESEARCH AND DEVELOPMENT?

During the last 25 years much educational research has tried to isolate cause and effect (method/outcome) relationships relevant to teaching/learning interactions. After arguing, in 1957 (and subsequently), for research into Aptitude x Treatment interactions (ATIs), Cronbach (1975) recognised the limitation of this approach:

> 'An ATI result can be taken as a general conclusion only if it is not in turn moderated by further variables.' (p. 119)

Goldschmid and Goldschmid (1976) identified 'learning skills' as one such further variable. They advocated the expansion of ATI to A(LS)TI 'to take into account the specific ways in which an individual goes about learning.'

Unfortunately other major variables are still unaccounted for. The 'Treatment' in ATI research is invariably a teaching or presentation method and the interaction is measured by a student performance assessment method. Research publications seldom give detailed descriptions or evaluations of this assessment; the research itself usually neglects the interaction effect that the assessment method has on student learning and therefore attainment. Also, for each individual student, another significant variable is the 'environment' of the course in a programme of study and affected by extra-curricular environments.

Docking (1976) argued that it is the intensely personal perception of environment that is the main agent for impact in education. Docking identified definition and measurement of achievement, and of environments, as two of 'four major problems which in effect invalidate all previous research into the impact of student/teacher interaction'. A third problem relates to statistical and research models and the fourth is lack of theoretical frameworks relating output to environmental and input variables. This last problem is explored by White (1981) with reference to directions in research on intellectual skills.

The student-referenced assessment model presented in this paper is a response to the fourth problem with reference to the first two. While the model could be used for research into interactions, there are important implications for managing the variables identified and for sharing the responsibilities with the individual student.

RELATIONSHIPS AND DEPENDENCIES

In exploring the relationship(s) between the quality of grades and student

quality, it is necessary to retain an appreciation of dependency. Grades depend on marks which depend on student responses to the questions of assessment. Or, as Isaacs (1974) puts it, 'the essential prerequisite for meaningful grades is meaningful marks'.

The meaning of marks will depend on or derive from the setting and marking of the questions of assessment. In the context of a course of study, if there is to be satisfactory (or even adequate) congruence of the intentions of the teacher(s), the experience of the students and the learning outcomes, then the 'quality' of the course is determined by the correspondence of assessment with course objectives *as perceived and experienced* by the student(s). Manifestly, these are considerations of the course as the student's immediate educational environment.

Student experience of a course is shaped by the course requirements such as the timetable, textbooks and assignments. Student learning is directly influenced by the assessment requirements. The assessment components may be in-course (or internal) or end-course (when timetable commitments have been completed), or a combination of both.

In developing an assessment model for a course, it is relevant to start with the model of a theory of school learning presented by Bloom (1976), shown in Fig. 1. Bloom emphasises the congnitive and affective aspects of the student's educational experience, represented as 'Learning Task(s)'. With this model as a starting point, the aim is to develop a model of student experience in which the student(s) enter with a general cognitive ability (SA), relevant knowledge (SK), motivation (SM) and student or study skills (SS), and leave with a particular grade or quality of grade (QG). This model is shown in Fig. 2 with assessment components (AC) replacing 'Learning Task(s)' and with the quality of the course (QC) including all aspects of control (or management) such as syllabus, classroom teaching, textbook and assessment feedback (to improve learning).

At this point it is necessary to clarify concepts such as general cognitive ability and motivation. For this purpose it is useful to consider Hall's (1977) summary of the relevant work of Vernon (1969). Vernon's (1969) view of intelligence leads to an identification of a general educational ability as a phenotypic intelligence. Vernon (1969) considers that there are three types of intelligence:

Intelligence A (Genotype)	-	genetic, inherited potentialities for growth; (no direct observation or measurement)
Intelligence B (Phenotype)	-	interaction of the genotype with the environment - the 'product of nature and nurture'; (observable as 'intelligent' behaviour)
Intelligence C (IQ)	-	measurements provided by tests of intelligence; 'an intelligence test is no more than a sample of the kinds of skills we regard as intelligent'

In Vernon's (1961) model of the structure of educational abilities, general educational ability comprises:

- general cognitive ability (Intelligence B)
- standard educational skills
- non-cognitive variables (persistence, industriousness, interest, temperament, physique)

'A third concept (of ability), general scholastic ability, is presented largely as an operational refinement of the concept of general educational ability. Whereas general educational ability relates to a "common ability" underlying examination performance, general scholastic ability relates to the complex of skills influencing performance on tests of scholastic ability. The essential distinguishing characteristic, in terms of Vernon's model, is that performance on tests of scholastic ability is unlikely to involve, to the same degree, the complex of non-cognitive

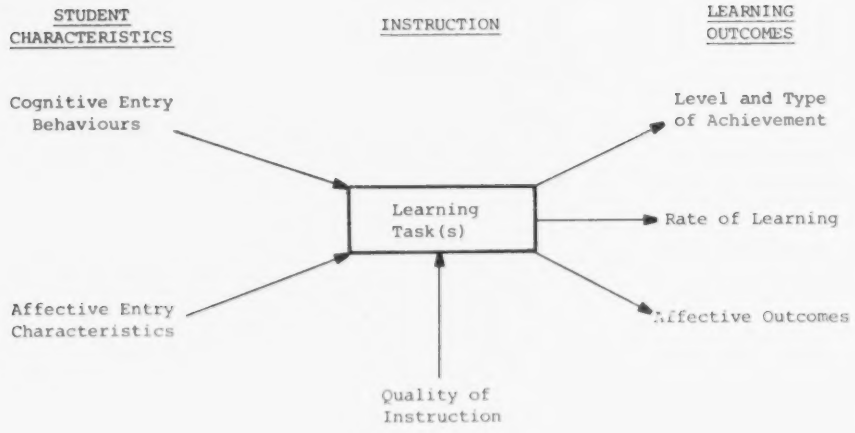

Fig. 1. Major variables in the theory of school learning (Bloom, 1976)

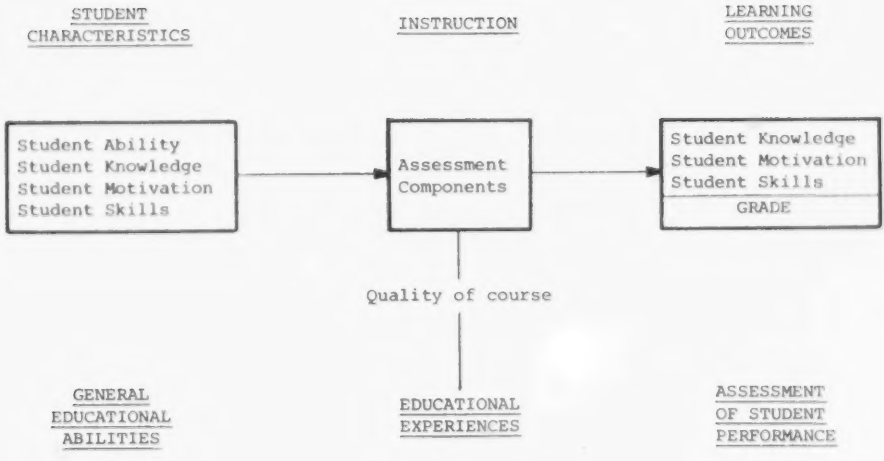

Fig. 2. An alternative model for student educational experience

factors which underlie examination performance; such tests are less likely to relate to the pupils' aspirations, interest, preparations and motivations.' (Hall, 1977)

For development of a student-referenced assessment model for a course, some of the concepts correspond to Vernon's work, as follows:

SA	-	Student Ability	(general cognitive ability or aptitude which is not subject or course-specific)
SK	-	Student Knowledge	(cognitive ability specific to the course)
SM	-	Student Motivation	(affective - persistence, industriousness, interest, perception of course requirements, *temperament* - all affected by the quality of the course)
SS	-	Student Skills	(standard educational skills - often referred to as study or learning skills)
SF	-	Student Feeling	(perception of assessment, physique/health, *temperament* - feelings which affect student performance *at the time of assessment.*
SQ	-	Student Quality	(includes all Vernon's factors of general educational ability except SF; SQ is also dependent on the quality of the course, QC)
SP	-	Student Performance	(this is the work done by a student for an assessment component, which will then be marked)

The development of the assessment model is based on the principle of functional dependency, e.g., the Quality of the Grade (QG) depends on the Meaning of the Mark (MM). Other qualitative considerations are used to show dependency of the meaning of a mark (MM), on

QM	-	Quality of Marking	(reliability, accuracy, validity of mark combination and presentation, etc.)
QQ	-	Quality of Question(s)	(as part or all of an assessment component)
QC	-	Quality of Course	(timetabled activities, materials, assessment feedback, etc.)

Note that, from a student point of view, the experience of a course is not completed until the final grade is known. Although the work of the course includes the final or end-course examination, it is separated as an identifiable assessment component in Fig. 3.

Student performance might be assessed completely by in-course assessment components as shown. For each assessment component, quality of marking (QM) and the meaning of the marks (MM) are important. When marks are combined, subsequent interpretation becomes more difficult and professional judgement needs to be informed about the effects of combination with reference to correlation and standard deviation (Imrie, 1981). Terwilliger (1977) recommends that grades should reflect only the teacher's judgement of the quality of a student's performance in achieving instructional objectives.

Fig. 3 shows the relationships of all the above variables in an assessment model for a course. The dependency or functional relationships can be represented more clearly by the following statements which correspond to the diagrammatic representation of Fig. 3:

QG = f (MM)		(grade quality depends on or is a function of the meaning of a mark)

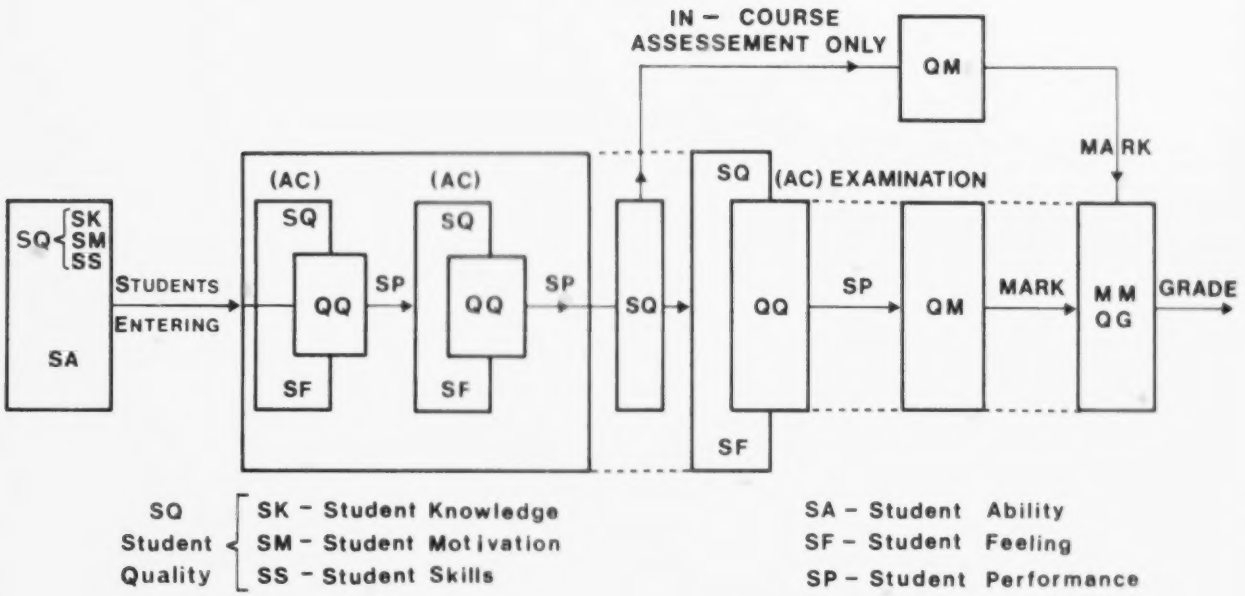

Fig. 3. A student-referenced assessment model for a course

MM = f (SP, QM)	(the meaning of marks is an interpretation function of student performance (in response to an assessment component) and quality of marking)
SP = f (SQ, QQ, SF)	(student performance is a function of student quality, quality of question(s) of the assessment component, and student feeling at the time of performance)
SQ = f (SA, SK, SM, SS, QC)	(student quality is a function of student characteristics at entry to a course, and the quality of the course)

Note:

(1) An assessment component (AC) may be in-course or end-course. Basically an assessment component provides for an interaction between student quality and question quality to produce a sample of student performance. If the assessment component questions are a truly representative sample of the course, then it is possible that the meaning of the mark will be a truly representative indication of student quality.

(2) An 'all things being equal' argument is developed thus:

(MM) - If the quality of marking is high and constant for all markers and all students (in a course), then MM = f (SP); the meaning of the mark is a function of student performance only.

(SP) - If the quality of the question is high and constant for all students, and if students are feeling well and not adversely stressed, then SP = f (SQ); student performance (for assessment) is a function of student quality only.

(3) A direct and valid relationship of dependency can now be said to exist between QG, MM, SP and SQ. The quality of the grade depends on the meaning of marks derived from student performance as representative of student quality.

CONCLUDING COMMENTS

A model (Fig. 3) has been developed which demonstrates the potential of a direct relationship between the quality of a final grade and the quality of a student. There is, however, no direct dependency on student ability represented as general cognitive ability (Vernon, 1961).

Student quality (SQ) certainly includes student ability (SA) but, for assessment in the context of a course of study, SQ also depends on student knowledge (SK), student motivation (SM), student skills (SS) and quality of course (QC). Any one, or a combination, of these dependent variables can compensate for variations in student ability (SA). For example, a student who is motivated to work hard can perform as well in assessment as a more able student who lacks motivation or has poor study skills.

The student-referenced model for a course links the general educational abilities of a student (SA, SK, SM, SS) with the quality of the course (QC), with reference to the principal stimulus for student learning or educational achievement, viz., the assessment requirements or components of the course. If the quality of the grade awarded to a student is to be unambiguously related to the quality of the student, then there are clear indications that professional skills (for quality control) are required to establish:

(a) a grading scheme which can be moderated (QG);

(b) procedures for marking, combining and interpreting marks (QM);

(c) procedures for assessment that are valid, reliable and measure what the student can achieve (QQ).

One major question which still has to be resolved, is that of sampling when student quality is assessed. The timing of assessment, the duration of the course, the time spent on assessment and the subject scope of assessment, are all important considerations when assessment components are planned and students perform.

From the teaching point of view, the model provides clear indication of factors with potential for the improvement of student quality and hence of student grades. First, course quality should contribute, obviously, to student quality. Course quality includes such considerations as course management, subject competence, teacher enthusiasm, communication skills and clear, consistent statements of course requirements. Academic staff should also understand how principles of learning can be incorporated in course design and in assessment. All of these considerations are teacher-controlled and have improvement potential.

And, second, there is thus the potential for interaction between course quality and student entry characteristics of motivation and relevant knowledge. Of particular interest is the student skills factor which has only recently been recognised as another important teacher-student responsibility in the context of a course of study.

With reference to these entry characteristics, individual needs can be diagnosed by relatively informal procedures which can also provide for socialisation when the class meets for the first time. The use of appropriate development strategies can then provide an important focus on student learning experience in the course, as distinct from content of the course. The potential for systematic development (trial and success rather than trial and error) can be realised only if there is teacher-student awareness of the factors involved.

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Chapter 6:
WORKSHOP REPORTS

The workshop has proved to be a very effective vehicle for a number of diverse purposes in higher education. For example, the interactions and "hands on" experiences so necessary when learning new skills and techniques are most appropriately provided in a workshop. Again, the sharing of experiences and exchange of views essential for heightening awareness of issues and problems can be most effectively facilitated by a workshop format.

In keeping with the traditions of past HERDSA conferences, the 1982 conference program also included a wide range of specialist workshops. Reports from six of these are included in this chapter.

The first, **Problem Oriented Learning: New Technique or New Paradigm**?, focusses on the reasons and techniques for optimising participation and self management of problem oriented gatherings. In his report Crombie details the current "dynamic conservatism" paradigm and the competing "life-long learning" paradigm and then indicates how the struggle between them relates to problem oriented learning. In **Scanning the Environment** Faris, Marriott and McCarroll provide details of a workshop designed to encourage participants to become more aware of their present and future environment, and its implications for them. Although developed originally for a diverse range of students in Applied Administration courses, they indicate the workshop has a much wider applicability.

Innovation is always threatening to an established system. Consequently those attempting to introduce innovation must be aware of the effects the particular innovation will produce when devising strategies for imbedding it in the system. In **Introducing Innovation or change** Brandt provides a brief outline of a workshop designed to make participants aware of the forces which may hinder or support innovation.

In the final sections brief summaries of three further workshops are provided - **Using Student Self-Assessment** (Boud, Lublin); **Improving Interpersonal Skills** (Barrand) and **The Evaluation of Teaching - Policies and Practices** (Knapper, Lonsdale and McDonald).

Problem Oriented Learning: New Technique or New Paradigm?

Workshop Leader:
Alastair Crombie, Australian National University

SUMMARY

It is argued that problem oriented learning is not simply a new technique that can be added on to conventional curricula, but is a new way of learning. The workshop explored the way in which this and other innovations in higher education are 'domesticated', by viewing them in the context of a paradigm struggle in education. The report following concentrates on a delineation of the present and challenging educational paradigms, and argues that authentic transformation of the quality of learning requires an epistemological revolution.

Alastair Crombie, B.A. (Reading), B.Phil. (York), Ph.D. (ANU) is in the Centre for Continuing Education. He began working in the adult education field after training as a sociologist. Over the past ten years he has worked extensively with public and private sector organisations and with community groups in the design and management of adult learning activities, and teaches in the area of adult learning theory.

Address for Correspondence: Dr. A.D. Crombie, Centre for Continuing Education, Australian National University, P.O. Box 4, Canberra 2601 A.C.T.

I believe that we are currently experiencing a paradigm struggle in education.(1) The existing educational order founded on monumental Acts of Parliament, vast educational bureaucracies, the professionalisation of teaching, preoccupation with cognitive, intellectual development, and almost exclusive concern for the young, is being invaded by a set of radically different and competing ideas as to what the whole enterprise of education should be concerned with. The intrusions of this competing paradigm are as yet sporadic and diverse, totally lacking the central characteristics of the system it seeks to overthrow - its vastness, durability and order - and yet no one active in the educational field today can be unaware of the fundamental challenges with which it is being confronted. We will of course make differing evaluations of these developments; one person's new paradigm is but anothers passing fad. For myself, I believe that an alternative educational paradigm is emerging, and I am in favour of nurturing its invasion of the present educational system.

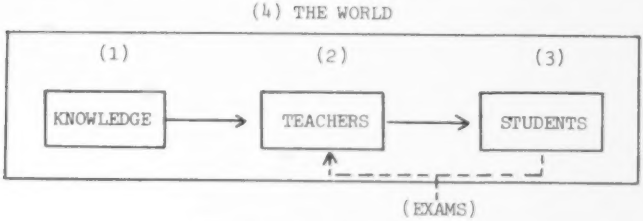
In filling out his vision of what education should be like, Paul Lengrand (1975) presents a useful descriptive overview of the main characteristics of the present paradigm and its challenger.

The existing system is curriculum centred, and defines teachers as the main, if not the sole agents of learning. Students are essentially the objects of education, and to become educated is to become a 'good adult'. Its official aim is the transmission of knowledge and cultural heritage as codified into curricula, subjects courses, etc., but in practice grading and selection by means of quantitative assessment has become an aim in itself. In terms of the methods and processes for achieving these aims, there is a heavy concentration on intellectual development, and the development of verbal skills and capacities in particular, with the result that education is somewhat dissociated from the rest of life. Competition, organised around examinations, grading, award of certificates, and so forth, is a principal source of motivation, and the basic organisational elements as are the class and the course, the lecture or lesson. For present purposes I will refer to this as Paradigm 1.

The competing system, which Lengrand so eloquently advocates, takes the needs and the interests of the learner, rather than the existing structure of knowledge, as its basic starting point, and as a correlate sees learners themselves, and not teachers, as the main agents of learning, supported and helped by a diverse range of resource people. The basic aim is cultivation of the ability and the desire to learn and go on learning. It is oriented to the development of all, based upon qualitative appreciation of each individual's unique progress and accomplishments, rather than quantitative and comparative assessment of success and failure. In terms of method and process it seeks to better integrate learning with the rest of life by premissing learning activities upon the learners life situation and interests, and supporting this intrinsic motivation by combining learners with similar interests into learning groups. Thus collaboration amongst learners with shared interests replaces competition as the typifying, though not exclusive learning situation. It seeks a better balance of all the skills and understandings that together constitute functional literacy in our society, and tries to nurture these in a non-directive and non-judgemental way. This is what Lengrand understands as 'life-long learning'. I will refer to it henceforth as Paradigm II.(2)

At this descriptive level we might note that an educational <u>system</u> becomes systemic on the basis of the relationships that it embodies amongst four basic components; the world - or what there is to be known; knowledge - the record of descriptions, explanations, analyses of this world; teachers - those persons who have acquired knowledge of some aspect of the world and are in a position to pass this on to others; and learners - all those who are in the position of wanting, needing, or getting knowledge from teachers. Paradigm 1 structures these basic elements in the following way:

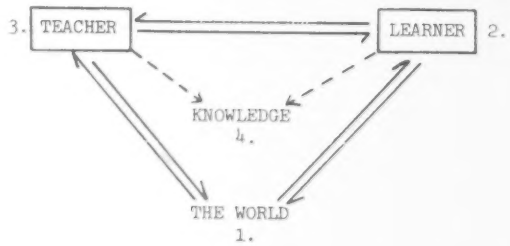
1. Basic Structure of Education Systems in Paradigm 1



The classroom becomes the doorway to reality. Education deliberately excludes the vagaries and complexities of the world, and introduces the learner to it instead via the mediation of texts, demonstrations, and so forth. There is no direct access to knowledge for the student - the systematic learning of a subject requires attendance at a time and place where a qualified teacher is at work and internalizing step-by-step the particular set of abstractions and rules with which that subject has been laboriously constructed. The reservoir of knowledge is of course kept topped up by the labours of researchers at the disciplinary frontiers in university departments.

Paradigm II implies a fundamental reordering of these basic elements:

2. Basic Structure of Educational Systems in Paradigm II



Here the world rather than our existing knowledge of it becomes the starting point. The role of the 'teacher' (different terms such as 'resource person', 'helper', 'facilitator', etc. are likely to be used) is to move alongside the learner and enter the learner's world. Teacher and learner are then in a position to identify learning needs and interests and invent processes by which the required skills and understanding may be acquired. Knowledge is then the product rather than the precursor of learning.

PARADIGM 1 - 'DYNAMIC CONSERVATISM'

The dominant educational paradigm it must be conceded, has demonstrated an extraordinary capacity for accommodating, assimilating, or ignoring good new ideas about education. Thus it is that for all the good work and inspiration of Montessori, Dewey, Neill, Freire, Illich and others, we have so pitifully little 'on the ground' in the way of genuinely different approaches to education. Our 'alternative' or community schools are scarce and have been prone either to languish or to become the domain of the educationally and financially privileged, while those universities which set out in the sixties to break the stranglehold of the disciplines on their research and learning have succumbed one after another to creeping Departmentalisation.

I agree with Dewey that we should make full use of experience in education for democracy; I agree with Montessori that we should 'educate the senses' by constructing and managing rich learning environments for the young; I agree with Neill's anti-authoritarian approach to education and his belief in self-government; I agree with Freire's strategy of education for liberation, and his exhorations to replace the 'banking' and 'nutritive' approach with problematizing and conscientiation. I sense too that these biases of mine are quite widely shared. I know for a fact that

publishers have been discharging a tidal wave of literature which is fundamentally critical of present systems of formal education. Why then is it still so incredibly difficult to create and defend spaces within this system in which some of the ideas and ideals of an alternative paradigm can be practiced?

In a masterly analysis of 'alternatives to hierarchies' Herbst (1974) has shown that there are two basic assumptions which generate the logic of bureaucratic organisation:

1. The organisational task can be decomposed successively into smaller and smaller independent parts
2. Each unit or person should be allocated exclusively to a single element.

These assumptions he calls the 'genetic core' of bureaucracy. So long as these assumptions are sustained it will not be possible to nurture a non-bureaucratic culture - one based on participatory democracy and self-management. Thus the whole spectrum of Organisational Development interventions - job enrichment and job enlargement, management by objectives, human relations training, team-building, and so forth - while they may have some effect in putting a 'human face' on bureaucracy, will not lead to genuine democratisation of work so long as they leave these assumptions intact.

In moving beyond the descriptive level it becomes clear that the genetic core of an education system is its epistemological assumptions, (Emery, 1981). Until these are correctly identified and supplanted they will, like the tap root of a virulent creeper, go on reproducing basically the same kind of education. It is our general habit to locate causes where symptoms are observed, so that for example problems with discipline, or low standards, or relationships between teachers or departments, are to be remedied by tougher control, or more difficult assignments, smaller classes or better communications amongst staff. I believe, however, that these and the other familiar maladies of formal education can be traced ultimately to its epistemological assumptions, and that here also can be found an explanation of the regularity and effectiveness with which competing educational ideas are 'neutralized'.

Accordingly, in order to be able to understand the nature of the struggle that is now going on, and more importantly perhaps to be able to influence the outcome, we need to delve beneath the surface manifestations of the two paradigms to uncover their 'axial principles', or genetic core.

THE CURRENTLY DOMINANT EPISTEMOLOGY

The epistemology which pervades western educational systems today is Empiricist (Emery, 1981). In the terms used by Stephen Pepper it belongs to the world hypothesis of Mechanism, for which the root metaphor is the machine. (Pepper, 1942). Feyerabend uses the term 'critical rationalism'. (Feyerabend, 1975). The development and defence of this theory has been associated with Galileo, Descartes, Hobbes, Locke, Hume, Berkeley, and more recently the logical positivists. It is epitomised in the notion of the universe as a Great Machine in which, as Laplace argued, only a shortage of information stands between us and the ability to predict every future state.

While this tradition has its internal tensions and variations, there are also some cardinal principles. The first of these posits an objective physical world 'out there', accessible to observation and description, but always separated from, and 'external' to the observer. This tangible reality in all its detail is there before we are born and persists after we pass away, as it was there before humans evolved and will be there when they are extinct. We are but actors upon the stage..... From this separation arises a rigorous determinism, the belief that the workings of the Great Machine are rule governed, and that the causes of all things can in principle be known. The universe is linear, causal, continuous and Euclidean; even though its surface manifestations are complex and heterogeneous, there are regularities which will bring it all to order if we can discover them, and the way to proceed is to analyse things into their constituent parts - to see 'what makes them tick'.

For all practical purposes, involving medium-sized objects on the surface of the earth, this is a matter of filling in the details not covered in Newton's classical

mechanics, and pursuing the identity of the ultimate constituent of matter until we can finally pin it down. "In the Newtonian view, God had created, in the beginning, the material particles, the forces between them, and the fundamental laws of motion. In this way, the whole universe was set in motion and it has continued to run ever since, like a machine, governed by immutable laws (p56)" (Capra, 1975). This world view has been the conventional wisdom for three centuries, and not many people outside the physical sciences are aware of the full extent of its obsolescence.

The psychology of perception and knowing that goes with this cosmology is that of the sense-datum theorists. Sensory impressions in the form of sound, light, smell, and so on, impinge on the sensory receptors (as 'stimuli'), are thence transmitted to the brain for processing, and where appropriate, memory storage. This has been characterised by Russell (1927) as the 'causal theory of perception', and its adherents as 'indirect realists'. (Shaw and Bransford, 1977). The most distinguished intellectual forbears of this position are Locke, Hume, and Berkeley, while Aristotle's concept of the newborn infant as a 'tabula rasa' - a clean tablet upon which experience prints impressions of the world, still exerts a powerful influence.

From an educational point of view the key element in this approach to perception is that it requires some sort of constructive cognitive activity to 'make sense' of the sensations collected at receptor surfaces such as the retina. Two-dimensional inverted images of patches and intensities of light have to be converted somehow to give usable information for depth and size constancy in an upright world. There is not much agreement as to how this process of construction might take place. Broadly speaking it is held that humans get to know the world as a result of associations forming between the elements of sense data that are collected. These are mentally constructed by processes of abstraction and generalisation, inference and deduction, into an ever more detailed and accurate representation or 'mapping' of the actual objects and events in the world. Capra (1975) puts it like this: "Rational knowledge is derived from the experiences we have with objects and events in our everyday environment. Abstraction is a crucial feature of this knowledge because in order to compare and to classify the immense variety of shapes, structures, and phenomena around us we cannot take all their features into account, but have to select a few significant ones. Thus we construct an intellectual map of reality in which things are reduced to their general outlines. Rational knowledge is thus a system of abstract concepts and symbols, characterised by the linear, sequential structure which is typical of our thinking and speaking (p.27)"

While the theory of learning which has stuck most faithfully to these empiricist precepts is of course associationism or behaviourism, the recently emergent cognitive and information-processing theories of learning share the same sensory concept of mind (Weimer, 1977)

This leads finally to a view of how knowledge is created and the steps by which additions to the corpus of knowledge can be made. Knowledge consists of true statements about the world and truth, like space and time, is absolute. Knowledge is to be strenuously demarcated from myth, metaphysics, common sense, fantasy, and so forth. Given that our sense organs receive only attenuated representations of reality, great care is required in constructing and following the rules by which the wheat of truth may be winnowed from the chaff of accidental association, idiosyncracy, bias and so on. Hence the rules of induction and inference by which generalisations may be advanced, and the tests of verification or falsifiability by which they may be affirmed or repudiated. The separateness of the person from the world creates a further demarcation between knowledge which can be considered scientific, and that which cannot, on account of its contamination with subjective factors such as introspection. Scientific knowledge is that which objectively describes and explains the external physical world free of the interests and values of the researcher. The progress of science is indicated by gradual extension of the area of stable, indubitable truths, as more and more of the scientifically unknown is explored and 'conquered'. This process is painstaking, arduous, slow, and frustrating, and is the preserve of the highest intellects.

THE EMERGENT EPISTEMOLOGY

Empiricist Epistemology has exerted a dominant, though not exclusive influence over educational practice. The signs are that the strands of an alternative, competing epistemology are at present being drawn together and articulated in a way that can challenge this dominance. Its major strands come from the 'new physics' of quantum mechanics, from ecological psychology, and from Eastern religion and mysticism, while the weft and warp comes increasingly from developments in the philosophy of science, the sociology of knowledge, and the sociology of education.[3] This emergent epistemology at present lacks the extension, durability and order of the theory it seeks to usurp but the symptoms of pressure, competition, intrusion, and mutual invasion which are characteristic of paradigm struggle have been growing apace over the past decade or so.

There is first of all a new cosmology, which emerged from the bowels of the old with the revolution in physics in the first thirty years of this century. Quantum mechanics has unvieled a world of unbroken, dynamic unity, in which transformation - constant flow and change - is all-pervading, in which no sensible meaning can be given to the idea of an observer separated from a world 'out there'. This universe is non-linear, discontinuous, a-causal, non-Euclidean. One leading theoretical physicist has characterised it as follows: "One is lead to a new notion of unbroken wholeness which denies the classical idea of analysability of the world into separately and independently existing parts..... We have reversed the usual classical notion that the independent 'elementary parts' of the world are the fundamental reality, and that the various systems are merely particular contingent forms and arrangements of these parts. Rather, we say that inseparable quantum interconnectedness of the whole universe is the fundamental reality, and that relatively independently behaving parts are merely particular and contingent forms within this whole (p.138)" (D. Bohm, cited in Capra, 1975).

Zukav(1979) characterised the old world view as a picture of 'order beneath chaos', of systematic and rational laws lying beneath the 'blooming, buzzing confusion' of daily experience, there to be discovered in the manner of Newton's discovery of gravitation. The new world view is by contrast one of 'chaos beneath order' - "The world view of particle physics is that a world without 'stuff', where what is = what happens, and where an unending tumultuous dance of creation, annihiation and transformation runs unabated within a framework of conservation laws and probability (p.213)" Capra's (1975) distinctive contribution has been to explore the extra-ordinary parallels and consistencies between the world view of modern physics and that of the way of the East: "The further we penetrate into the submicroscopic world, the more we shall realise that the modern physicist, like the Eastern mystic, has come to see the world as a system of inseparable, interacting and ever moving components with man being an integral part of this system (25)" The two key common themes are the unity and inter-relation of all phenomena and the intrinsically dynamic nature of the universe.

How can human beings perceive and know this 'cosmic dance'? As demonstrated by Emery (1981), the breakthrough here has come with the development of an ecological approach to perception. This new theory of perception asserts that the environment for human behaviour has an information structure, and that humans can extract information directly by means of perceptual systems which have evolved for this purpose, and which become 'tuned' to the environment by experience (Gibson, 1966,1979) The newborn is not a 'tabula rasa' at all, but arrives equipped with a set of over-lapping perceptual systems which evolution has attuned for the obtaining of meaningful information directly from the environment. Unlike the 'sense organs' or 'receptor surfaces' of previous theories, these perceptual systems do not wait inertly for stimuli to impinge on them, but begin actively to mine the information present in the environment in a self-regulating quest for perceptual clarity. In this theory of direct perception the neuro-processing, construction stage of the causal theories of perception is unnecessary. Depth in the visual field for example, is directly given to perception in such properties as texture gradients and occlusions, and does not have to be produced in the head by some abstruse processing of cues for binocular disparity and so forth. Gibson calls his new theory of perception the theory of 'information pick-up', and its central assertion is that perceptual systems concurrently register both persistence and change in the stimulus flux by extracting the invariances in this

flux. The visual system for example extracts invariances from the ambient optical array.

Two other aspects of the theory are of special relevance in this context. Gibson's analysis of what there is to be perceived leads him to the conclusion that we are immersed in an inexhaustible sea of energy - mechanical, luminous and chemical - such that any perceiver with intact perceptual systems can go on obtaining further information without limit.

Moreover, if perceptual systems replace sense organs as the appropriate locus for this active perceptual activity, the process of information pick-up is amenable to sytematic improvement. "It would be expected that an individual, after practice, could orient more exactly listen more carefully, touch more acutely, smell and taste more precisely, and look more perceptively than he could before practice (p.51)" (Gibson, 1966). As the child matures he learns to use his perceptual systems more skillfully, and his attention becomes educated to the subtleties of stimulus information (p.5)" (Gibson, 1966).

In other words, learning to perceive is in itself central to the educational process: "The extracting and abstracting of invariants are what happens in both perception and knowledge. To perceive the environment and to concieve it are different in degree but not in kind. One is continuous with the other. Our reasons for supposing that seeing something is quite unlike knowing something comes from the old doctrine that seeing is having temporary sensations one after another at the passing moment of present time, whereas knowing is having permanent concepts stored in memory (p.258)" (Gibson, 1979)

We turn finally to the question of how within this new epistemology knowledge is to be created - what are the agreed procedures by which additions to the corpus of knowledge can be made? In some respects this very question becomes meaningless, because it refers back to the Cartesian partition between "I" and the world, and the correlated notion that our ignorance of the Great Machine can be progressively conquered by scientific enquiry. The first point to emphasise therefore is that the old idea of objective knowledge of facts gathered with neither fear nor favour and available to all for corroboration, passes away. "Participator is the incontrovertible new concept given by quantum mechanics. It strikes down the term 'observer' of classical theory, the man who stands safely behind the thick glass wall and watches what goes on without taking part. It can't be done, quantum mechanics says (p.1273)" (Wheeler et als, 1973) In place of the traditional idea of Absolute Truth come the more modest criteria of pragmatism - an operational theory of truth - "truth in terms of action, of actual events (p.268)" (Pepper, 1942) The truth test of pragmatism is consistency with our experiences.

The inability to get apart from the world in order to study it 'objectively' has decisive consequences for any existing principle of demarcation. Science becomes continuous with common sense, and with all other forms of knowing. Scientific enquiry has its unique characteristics, both strengths and weaknesses, but it is not in principle separable from other ways of knowing. In advancing the case for 'epistemological anarchism' Feyerabend (1975) suggests that argument may retard science, and deception may usefully advance it - "Add to this what we have learned about the ordering principles of myth, religious enthusiasm, abnormal experiences, and one will be strongly inclined to believe that there are many different ways of approaching nature and society and many different ways of evaluating the results of a particular approach, that we must make a choice, and that there are no objective conditions to guide us (p.196)"

Whatever the competence of the enquirer and the brilliance of his methodology there is a fundamental limit to the product of the intellect, a relativity which pervades all rational knowledge. As the progenitor of general semantics puts it, 'the map is not the territory', (Korzybski, 1933) or, we might say, the text is not the reality. This is not to dispute for a moment the practical success and utility of the descriptions and explanations of events and objects on the surface of the earth that science has given us, simply to say that that is not all there is. Beyond reason lies the direct experience of reality which transcends sensory perception and cognition: "The Eastern mystics repeatedly insist on the fact that the ultimate

reality can never be an object of reasoning or of demonstrable knowledge. It can never be adequately described by words, because it lies beyond the realms of the senses and of the intellect from which our words and our concepts are derived (p.29)" (Capra, 1975).

PROBLEM ORIENTED LEARNING

This is not the place to explore in detail the processes by means of which epistemologies find expression eventually in classroom practices, although this I maintain is precisely the kind of understanding which is required if we want educational changes to have effects rather than be assimilated to the assumptions of the dominant paradigm.

The starting point for this excursion was an interest in problem-oriented learning at tertiary level, and I want to conclude simply by showing that the prospects for problem-oriented learning are intimately bound up with the paradigm struggle in education as a whole.

The exemplar of the kind of learning approach that I have in mind is in the Green Bay campus of the University of Wisconsin which established itself as a problem-oriented university in 1975 and has since organised all of its academic activity around defined problems which relate to the broad generative theme of environmental quality. Courses and research projects alike are structured by the problem analysis, and not by the structure of disciplines. Griffith University, again starting with a 'green fields' site, is the only comparable innovation in this country. The record in established universities of attempts to introduce similar problem-oriented education is enlightening in terms of the conflicts that invariably ensue, and dismal in terms of results. Why is this so?

While I do not pretend that there is one simple answer to this question, there is a pattern to the fate of such innovations and their supporters across geographical, historical and subject boundaries such that I believe it must be referred to the underlying theory of knowledge.

Within the Empiricist paradigm 'problems' are the preserve of the elite of scholars who work at the farthest frontiers of disciplinary research, illuminating and unearthing the previously hidden and unknown. Once their work is done and these scholars move on, they have transformed the unknown into the known and rendered it unproblematic - this is what creating knowledge means. Henceforth to search for problems in this material is akin to fossicking in the mullock heaps of a disused mine; there may be a few worthwhile bits and pieces left to pick up, but the real pay dirt has been removed. Devotees of the Empriricist position are thus inclined to disparage problem-oriented learning as gimmickry, a contrived rehashing of the already known to render it spuriously problematic for teaching purposes. Broudy and Palmer (1965) dismiss the experience focus of progressive education: "A technically sophisticated society simply does not dare leave the acquisition of systematized knowledge to concomitant learning, the by-products of projects that are themselves wholesome slices of juvenile life. Intelligence without systematized knowledge will do only for the most ordinary everyday problems. International amity, survival in our stomic age, automation, racial integration, are not common everyday problems to which common sense and a sense of decency are adequate".

Thus are the 'uneducated' disenfranchised.

Where 'problems' <u>are</u> a part of conventional curricula one very often finds that 'problem' is used in the sense of 'riddle', as with algebraic problems. The learner is given tasks which include one or more 'unknowns' which can be worked out by the correct application of a formula. Problems of this sort require rote learning and memorisation by the learner rather than creativity and persistence. A further way in which problems have been assimilated into the standard curricula is via courses on 'problem-solving' which aim to transfer to students batteries of techniques such as Delphi, Brainstorming, Synectics, Lateral Thinking, TKJ and so on. Even Paulo Freire's revolutionary concepts have been domesticated for use within the dominant paradigm.

In a critical analysis of the way in which various non-formal education programs have neutered Freire's ideas Kidd and Kumar (1981) comment: "Problem-solving is in fact a pseudo-Freirean version of Freire's concept of 'problematization'. The inclusion of 'problem-solving' as one of the skills to be taught through a literacy program implies that adult illiterates are poor problem solvers. Such a view of the people obviously does not regard the survival techniques used by them to cope with a hostile economic structure and difficult physical circumstances as problem solving skills (p.9(33)"

One is, therefore, lead to the conclusion that problem-oriented learning requires an epistemological revolution. In fact it is apparent that Paradigm II is as hospitable to problem oriented learning as Paradigm 1 is hostile to it. In the alternative paradigm learning is set going when some aspect of the world is experienced as problematic, and it is assumed that there are as many valid ways of knowing the world as there are perceivers of the world. Problems are, therefore, endemic in perceiving and knowing, and not found only at the margins of exploration where new ground is being broken.

It remains only to point out that what is true of problem-oriented learning is equally true of the whole range of pedagogical and curriculum reforms which seek to transform learning experiences within the Empriricist paradigm. This, it seems to me, presents members of HERDSA and the 'Teaching and Learning Units' to which most of them belong with an interesting and important choice concerning the role which they might play in the future of tertiary education.

NOTES

(1) I am here using the conceptual framework of Kuhn (1962)

(2) For similar efforts to describe two kinds or cultures of education, see especially Knowles (1975) distinction between 'pedagogy' and 'andragogy', Bernstein's (1975) distinction between 'integrated' and 'collected codes', Holt's (1976) distinction between 'S-chools' and 's-chools', and Freire's (1972) distinction between 'banking' and 'problem posing' education.

(3) These latter influences are not explored here. The interested reader could begin with Young (1971), Brown (1973), Bourdieu and Passeron (1977), Bowles and Gintis (1976), and Bernstein (1975).

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Scanning the Environment

Workshop Leaders:
M. Faris, F. Marriott and G. McCarroll,
Royal Melbourne Institute of Technology

SUMMARY

The workshop presented the structure for a task which provides students with the opportunity to leave the classroom and explore some aspects of the organizations or groups in society, with particular focus on the future.

The basic structure and ideas for other uses are provided in the report following.

M. Faris, F. Marriott and G. McCarroll are all in the Department of Administrative Studies at the R.M.I.T. and lecture in Applied Management. Their department is actively involved in providing meaningful learning experiences for mature students, as well as being increasingly mindful of staff needs for a satisfying work environment.

They teach students taking a major in Administration with special streams in Public Administration, Local Government, Transport Economics and Secretarial Studies.

Address for Correspondence: M. Faris, Department of Administrative Studies, Faculty of Business, Royal Melbourne Institute of Technology, Box 2476V, G.P.O. Melbourne Vic. 3001

1. The issues we are addressing here are how to encourage students to

   - become more aware of their present and future environment and its implications;
   - become alive and responsive to the world around them;
   - leave the safety of their text books.

   The means we have developed to do this is centred around scanning the environment of a particular organisation or group.

2. The issues mentioned above are important to us for the following reasons:-

   (i) At R.M.I.T. we teach Applied Administration to two distinct groups of students within the same classes and courses -

   (a) part-time students - some with set views and many focused primarily on their current jobs and its problems;

   (b) full-time students often straight from school; some without any work experience, who have little conception of the world of work.

   (ii) We also want to get all students to look at work and organizations from a macro perspective, - as part of a larger system and as existing within time. At some point in the future they are likely to be the ones responding to changes in society.

   This macro perspective is also an attempt to help students realize that "the dissatisfied worker" is only one point of view! The world looks different from the top!

   (iii) We also want to make a real contribution to R.M.I.T's objectives for the decade to 1990, e.g., 'to assist people develop the capability to contribute effectively to a changing society'.

   'Foster in students and staff the creativity, adaptability, confidence and capability to meet the changing needs and circumstances of their lives and chosen occupations'.

3. The second unit of Administration that the students study in their first year is focused on organizations and their environment and runs over 14 weeks.

   In its design, we believe we have come up with some ideas and a simple methodology for helping any group begin to look at an organization or an issue in terms of its present and future within the environment , as well as develop certain skills.

   We believe the approach is also particularly relevant for

   - professional students in looking at the present and future of their professions and the implications for them and their training;
   - groups who need to assess and respond to their environments, e.g. churches, corner stores, education units;
   - course designers who need to plan courses relating to future needs of students.

4. So the aim of the exercise could be one or more of the following -

   - to look at a group, issue, etc., in context or develop a fuller appreciation of it;
   - assess current and future pressures and start planning appropriate responses;
   - develop scanning, research, conceptual, decision making and group skills, and clarify values.

5. In our course we

   (1) Introduce them to the concepts of future and scanning.

   (2) Hand out steps to help in dealing with the task and the group process, i.e.

TASK	PROCESS
. Define organization. . Define its environment. . Scan its environment. . Describe the environment -analyse and identify trends. . Predict how these will effect the organization and some ways it can respond. . Write up the report.	. Form the group. . Organize internal structure. . (Deal with conflicts). . Work on Task with . Feedback and Control. . Closure.

   (3) Get students to choose an organization from those offered, e.g. in our 1981 course the V.F.L., a shoe manufacturer, T.W.U., a Citizens Advice Bureau. The task is to be a committee to report to management on what environmental factors are likely to have a major impact on the organization in the next 10 years.

   (4) Form groups and go.

6. Some particular skills are needed.

Scanning Skills. These are perceptual skills similar to those required by a radar operator, used to pick out significant aspects of the environment.

The scanner needs to focus on an appropriate range or aspect;
have patience to cover the ground throughly;
recognize significant objects or to test for whether they are significant or not (e.g., by a literature search).

So like radar, the scanner establishes

- the Sector - the direction of attack or reinforcements;
- the distance - and
- the size.

These last two give an indication of importance, i.e., close and big is an important threat or help.

Skills in creativity - e.g., brainstorming techniques.

Group Skills - maintenance and task, e.g., Bales Interaction Analysis headings.

7. *In the Workshop we went through some of these steps using HERDSA as the organization (because it was familiar to participants).*

We suggested the following steps:-

1. *Consideration of future trends in Australian Society.*

2. *Given HERDSA as the organization to focus on; select one of (a) or (b):-*

   (a) key aspects of the environment, i.e., suppliers, customers/clients, competitors, regulators;

   (b) key forces in the environment, i.e., economy, politics, law, technology, social change.

3. *Brainstorm key individuals, groups and organization in the environment. Assess their present and future importance. And whether their influence is likely to be positive or negative.*

4. *(a) Brainstorm possible sources of information about these key units in terms of past trends, future perspectives, etc.*

   (b) List means of accessing the information.

   (c) Assess likely time required and any training/preparation required.

5. *Report on key trends predicted. Assess the impact of these on the organization chosen in terms of, e.g.:-*

   - *organizational structure;*
   - *organizational membership;*
   - *main task.*

We did not have time for (c) and 5, but these were included to give a sense of the completed project.

The task was to identify critical aspects of the HERDSA environment, i.e., aspects that are likely to have a direct impact on HERDSA.

These aspects needed to be evaluated in terms of the type of influence they were likely to have - positive or negative, and their relative importance.

8. *Participants divided into groups of three and started the task. The "tutor" kept an ear on what was happening and helped when required - mainly by synthesizing problem statements and reminding groups about the 'no evaluation' law of brainstorming.*

Groups fed back what they came up with and briefly discussed the experience.

9. *To start the discussion (Step 1), a list of statements was provided about the future of Education, taken from a paper by Professor Karmel.*[1] *(Appendix 2). This provided some alternative scenarios.*

Some readings on scanning and futures were given out also. (Appendix 2).

10. Reflections. (a) The critical features of this process are

- . a setting/context, i.e,, an objective;
- . a task, preferably with no right answer;
- . the necessary skills;
- . closure/evaluation.

(b) The HERDSA group showed similarity with our student groups in the amount of discussion and debate generated, the richness of group process, and suprisingly, given the experience of the conference group, the difficulty in identifying a problem area. Our learning from this is work harder to help the students start the task.

(c) The content of the discussion was interesting in terms of trying to identify who were HERDSA's suppliers and customers. If they were the membership, then HERDSA seems to be a closed system and liable to stagnation.

(d) The methodology is open to a number of options. For example:

- . the balance of task and process;
- . the use of scenarios of the future. Usually four are presented in the literature. One organization could be viewed from each scenario-to get the most optimistic and pessimistic picture;
- . a number of groups could look at the same aspect and compare notes afterwards;
- . pre and post measures of skills and attitude change could be undertaken.

Also, as a result of the Workshop, we believe it can be designed around widely differing time scales - although one and a half hours was a bit short for fourteen weeks work!

CONCLUSIONS

The task of scanning an organization's environment has provided us with a highly motivating exercise for undergraduate students, while providing important learning about futures, organizations and group dynamics.

Running the Workshop at HERDSA has made us more appreciative of some difficulties in starting the task, but has also prompted us to think about a wider variety of applications for the exercise.

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APPENDIX 1

EDUCATIONAL FUTURES

The following statements are presented to enable you to speculate about the nature of the educational environment in Australia in the 1990's.

1. Unemployment will continue to rise.

2. The rate of population growth will decrease.

3. Higher qualifications will give young people an advantage in searching for employment.

4. There will be a decreasing proportion of the G.N.P. devoted to education.

5. Tertiary education as it now exists will not cater adequately for the new skills required in the 1990's.

6. Tertiary education staff will become more conservative as permanent appointees serve out their time.

7. Tertiary education will become more flexible in response to changing demands.

8. Education will become increasingly geared to manpower requirements rather than to 'educating'.

9. Professional support groups will become less important to individuals in the professions.

10. Non-educators will do an increasing proportion of the teaching in tertiary courses.

11. Increased sharing of people and resources will result in a loss of excellence.

12. Creativity and innovation are usually expensive and resource consuming.

13. Education research will not be able to prove its cost effectiveness.

APPENDIX 2

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Introducing Innovation or Change

Workshop Leader:
Dietrich Brandt, Technical University (RWTH), Aachen

SUMMARY

This workshop was first suggested by Joan Conrad, University of Copenhagen (Denmark) and Peter Veltmann, University of Utrecht (Netherlands): it is based on concepts discussed by K. Lewin and by R. Davis and others.

Whenever we attempt to introduce an innovation into a complex system we must be aware that significant change always threatens to revolutionize the entire system. For innovations to survive, the total environments within which innovations are imbedded must be changed. The workshop is designed to make participants aware of forces which may support or hinder innovations. A brief report follows.

D. Brandt is a physicist with teaching experience at universities in Germany as well as at the University of London and M.I.T. (U.S.A.). He is director of the Centre for Research into Higher Education at the Technical University of Rhineland Westphalia, Aachen, West Germany. In 1982 he spent his study leave at the Centre for the Advancement of Learning and Teaching, Griffith University, Queensland, Australia.

Address for Correspondence: Dr. D. Brandt. Director, HDZ,Rolandstrasse 7-9, 5100-Aachen, W. Germany.

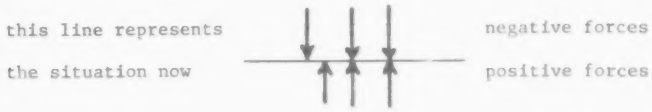
AIMS OF THE WORKSHOP

The aims of the workshop are:

(i) to share experiences among participants about their attempts to introduce innovations;
(ii) to define in some detail, for a few examples described by the participants, forces which may support or hinder change;
(iii) to design an exercise, e.g., a scenario, a role-play, a case study, which allows participants to anticipate the response of the environment in which change is to take place.

OUTLINE OF THE WORKSHOP

With reference to Lewin's terminology, a force may be considered as a tendency to support or hinder innovation. A 'force-field analysis' may assist in determining the influence of positive forces (which push toward 'positive' change) and negative forces (which resist improvement or represent deterioration).



The participants of the workshop were asked to go through the following steps in a format similar to 'brain-storming'. Step 1 and 2 were taken as an individual exercise: after deciding on one particular problem to be dealt with by the group as a whole, the participants proceeded through steps 3 to 8. Step 9 was discussed in general terms.

1. Select a problem

Identify the problem you want to work on:
- select a problem you anticipate you can do something about
- make sure it is something in which you can be personally involved
- make your problem specific

2. Describe the situation

- as it exists now
- as you would like it to be

3. Restate your problem

Be sure to show the direction of your desired change in terms of the situation as you have described it above.

4. List the negative forces

Include personality factors, lack of physical resources, antagonism of people involved etc.

5. List the positive forces

Include support from your colleagues, favourable policy decisions etc.

6. Reduce the negative forces

List action steps to reduce the most important negative forces.

7. Increase the positive forces

List action steps to increase the most important positive forces.

8. Design a strategy for change

Select the most promising action steps taking into account the following considerations.

a) Would you take the risk of conflicts or would you prefer to avoid conflicts?

b) Do you need personnel (or personal) changes inside the system?

c) Do you want the innovation to keep a low profile or do you think it desirable to approach the innovation openly?

9. Design an exercise

It would be desirable to test the strategy developed in steps 1-8 before putting it into practice: Design an exercise for this purpose - e.g., a scenario, a role-play, a case study - which could be used among a group of your colleagues. The exercise should allow participants to anticipate the response of the environment in which change is to take place.

The problem dealt with by the participants of the workshop may be described as: How can a Staff Development Unit find acceptance and cooperation with a department if the Head of Department is hostile towards the unit.

Using Student Self-assessment

Workshop Leaders:
David Boud, University of New South Wales
Jackie Lublin, University of Sydney

SUMMARY

One of the most important skills that should be developed as part of an undergraduate course is the ability to be able to assess one's performance, to know what it is that one knows, and to be aware of the limits of one's knowledge. Commonly, little opportunity is formally provided for students to practice these skills.

The aim of the workshop was to introduce participants to the idea of student self-assessment, to present case studies on the use of self-assessment in undergraduate courses, and to assist participants in developing self-assessment strategies for use in their own teaching.

The following activities took place:

- Discussion of "Why is it important that undergraduate students should acquire the skills of self-appraisal?"
- Presentation by the leaders of case studies in the fields of Landscape Architecture, Mechanical Engineering and Electronics.
- Sub-group activities in which participants from cognate areas developed an outline for a self-assessment exercise in one of their subject areas. These included physiology, micro-teaching in teacher education and dentistry.

Reference was made to recent publications by the authors on the topic of self-assessment:

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Address for Correspondence: Dr. D. Boud, T.E.R.C., The Unviersity of New South Wales, P.O. Box 1, Kensington 2033 N.S.W.

Improving Interpersonal Skills

Workshop Leader:
John Barrand, University of Sydney

SUMMARY

The workshop was advertised as aiming to:

(a) give participants ways by which they could attempt to improve their interactions with others with reasonable hope of success:

(b) use techniques by which participants might view their own interactions safely with others in a new light:

(c) demonstrate techniques for monitoring desired changes.

Twelve participants joined in the intimate space available. As a first exercise they were asked to pair off with someone they did not know and talk together for 15 minutes. At the end of that time, each was to present his or her partner to the group, the presentation to include some things the presenter thought interesting about the person, and what the person hoped to get out of the workshop.

A videotape recording was made of the participants pursuing the task.

At the end of the allotted time the presentations were made. Most of the introductions detailed individual's professional activities and accomplishments and only a very few gave any kind of personal picture. Objectives varied from the hope of finding ways to solve the administrative problems of an institution to simple curiosity about what was to happen in the workshop.

Sufficient of the videotape was replayed to allow the participants to see themselves in action. This was not processed, but left to link up with the final videotape exercise to provide more curiosity in and greater motivation to use this kind of confrontation.

A brief didactic input by the group leader followed which was intended to outline verbal responses at different levels of interaction, and which could encourage freer communication.

The group then moved on to an exercise using brief segments of filmed material as stimuli. Participants discussed their feelings and responses to the vignettes in pairs before sharing with the group whatever of their feelings they felt able. The group leader, without making it explicit, used the techniques outlined in the didactic input to facilitate this process. Several vignettes were used in this way before examination of the concepts on which they had been constructed.

Finally a method of self-assessment was demonstrated in which two participants recorded an interaction on videotape and were enabled to review the recording with a checklist of questions.

Address for Correspondence: Dr. J. Barrand, Dept. of Community Medicine, University of Sydney 2006 N.S.W.

The Evaluation of Teaching— Policies and Practices

Workshop Leaders:
Christopher Knapper, University of Waterloo, Canada
Alan Lonsdale, Western Australian Institute of Technology
Rod McDonald, Murdoch University

SUMMARY

Recent position papers by such organisations as HERDSA and AVCC reveal an increasing concern about the evaluation of tertiary level teaching, both for staff self-improvement and for career advancement purposes. While in most institutions teaching is ostensibly regarded as a major activity for academic staff, there continue to be problems and disagreements about appropriate criteria for effective teaching, and with how teaching performance can best be assessed. This workshop involved a discussion of recent policy statements on the evaluation of teaching and an introduction to various types of teaching appraisal, including student ratings, peer review and a more comprehensive Canadian approach, the teaching dossier. The latter aims to combine various sources of information about teaching effectiveness for use in tenure and promotions procedures. The workshop included didactic presentations, practical exercises and the opportunity for discussion.

Among the points that emerged in discussion were:

The role of staff development units in carrying out summative evaluations - in particular the extent to which units risk compromising their independence and neutrality if they play an active part in administering teacher evaluations for the purposes of tenure and promotion decisions; the difficulties of getting staff to take on themselves the onus of documenting their own teaching performance and instructional effectiveness (a notion implicit in the idea of the teaching dossier), especially in a climate where the institution places more emphasis on research and scholarship; the question of convincing staff that any method of evaluating teaching was truly valid - although the same objection might equally be made with respect to the evaluation of research and service to the institution and the community; the problem of getting department heads and tenure committees to put in the necessary effort to review and weigh the wide range of evidence that is relevant to the evaluation of teaching and which would be included in a teaching dossier.

Despite these reservations, there appeared to be a general agreement that teaching was a sufficiently important staff activity to warrant considerable care and effort with respect to its evaluation, and that an approach such as the teaching dossier offered considerable promise in providing a broad range of information, as opposed to the traditional reliance on a single source - such as hearsay or student course ratings.

Address for Correspondence: Dr. R. McDonald, E.S.T.R. Murdoch University, Murdoch 6150 W.A.

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